July 1964

culture

SELECTED CONTENTS

Published for the Ministry of Agriculture, Fisheries and Food by Her Majesty's Stationery Office

Agriculture

VOLUME 71 · NUMBER 7 · JULY 1964

Editorial Offices
Ministry of Agriculture, Fisheries and Food
Whitehall Place, London S.W.1. Trafalgar 7711

CONTENTS

The £ s. d. of QUALITY MILK

SINCE November, 1963, the Milk Marketing Board have been paying milk producers who sell their milk by wholesale according to its compositional quality. The present scheme will be modified this autumn, so that the three broad quality bands now in operation will become fourteen narrower bands. Three bands show a price reduction of 0·8*d.* per gallon for each 0·1 per cent of total solids below 12 per cent and ten bands show an addition of 0·3*d.* for each 0·1 per cent above 12·1 per cent. A range of 5·4*d.* per gallon is indicated between the highest and lowest grades.

Obviously such a scheme has important economic implications for producers, particularly for those likely to incur penalties. Apart from the possibility of giving up milk production, such producers have the choice between accepting the lower grading or attempting to move to a higher grade.

Those accepting the lower grading can, of course, make some compensating changes in their farming to make good the reduction in income. Keeping more dairy cows is an obvious move, but it is likely that if the penalty adds up to 2*d.* a gallon or more, a fairly substantial increase in cow numbers is required to get back to the pre-penalty position.

What is the cause of poor milk?

Recognition of the causes of low compositional quality must precede any attempt at raising quality. First, all causes to do with infertility, mastitis, milking techniques and other technical factors should be put right. Second, feeding aspects should be considered. The Milk Marketing Board have stated that, in the vast majority of cases, low solids-not-fat are due to inadequate feeding, and so there may be good prospects of improvement in some herds. Cows should be steamed up, the best quality fodder kept for the cows in milk, and concentrates fed a little more liberally perhaps throughout the difficult spring and autumn periods.

Owing to the complex nature of the influence of feeding on milk quality, technical advice should be sought and budgets prepared to show the probable costs and returns for each intended change. It may well be that higher yields accompany an improvement in milk quality in response to better feeding methods. Quality can be maintained and improved by regularly spaced calvings throughout the year and by a reasonable age distribution, since older cows may have a depressing effect on quality.

The long-term objective, however, should be to cull cows producing low quality milk. This will involve individual tests. Producers should be warned that substantial culling may have to take place before any appreciable effect is seen on the bulk sample tests.

Bring in Channel Island cattle

Finally, there is the possibility of bringing in cows of a high-quality milk breed such as Channel Island cattle. This may be the quickest method of improving quality if there is a desperate need to maintain income. The great advantage of including Channel Island cattle is that income can be maintained with the same or similar cow numbers simply because these cattle quickly raise the quality for the whole herd. The exact effect, of course, depends on relative milk yields and stocking rates. Some producers find this alternative a possibility, whilst others find management problems involved.

Long-term look

The Milk Marketing Board have said that the new 'multi-band' scheme provides an incentive to improve but not an incentive to chase quality regardless of cost. Producers above the 12 per cent total solids line may be satisfied with their grading. Nevertheless, since payment by quality is likely to be an accepted fact in the future and changes in the method of payment may be made from time to time, it behoves all producers to consider their position carefully and ascertain the long-term scope and cost of improving quality in their own herds. The maxim is that additional costs should not outweigh additional returns.

To summarize, it appears that unless there are low cost systems of farming associated with the production of milk of less than 12 per cent total solids, then most producers in the lowest quality grades will probably attempt to improve their position. But unless there is something obviously wrong, which can be put right quickly, improvement may be a fairly long job. The price differentials between quality grades also suggest that diagnosis of the factors depressing quality and careful planning will be worth while in the majority of herds.

J. A. Langley, University of Exeter

New Perspectives

J. H. KIRK

MINISTRY OF AGRICULTURE

discusses the eight articles which have appeared in this series and adds some further reflections

AGRICULTURAL marketing seems to mean very different things to different people. This has been manifest in the variety of topics discussed in the 'Marketing Today' series, which has appeared in these pages since October last. There is, for example, not much in common between the descriptive accounts of the group marketing of veal and eggs given by Messrs. Mansfield and Eastwood (or by Mr. Downey of the group marketing of weaners) and Mr. Houston's vision of more and bigger statutory marketing boards, firmly controlled in the public interest it is true, but reaching well out into processing and distribution. Mr. McClelland, too, chose a distinctive topic in his discussion of what the supermarkets expect from farmers and can offer them in turn.

It is indeed one of the awkward problems in developing agricultural marketing policies that simultaneously it is necessary to consider, not only the actual practical processes of marketing and the detailed ways in which these can be improved, but also the claims that are put forward, sometimes elevated into philosophies, as to where control of the marketing process should rest. The link between the two approaches is the argument that little improvement in marketing method is possible without large-scale operation, perhaps calling for a near monopoly and backed up by powers of compulsion; whereupon the choice of the recipient of these powers becomes an important issue of politics.

Selling groups

Several of the previous contributions (indeed all except those of Mr. Houston and Mr. Rhys Thomas) seem to have assumed, at least for purposes

of argument, that the overall control of the marketing system may rest where it now stands, and that the important thing is to find ways in which individual farmers and traders can do their selling jobs better. Four of the articles have brought out the scope for collective action by farmers to do their selling as groups, though Mr. Rhys Thomas seems to assume a little too readily that his substantial experience in organizing buying groups can apply also to selling groups, where there is less experience and it is less conclusive.

If all selling groups were as well disciplined and commercially alert as those described by Messrs. Mansfield, Eastwood, Downey and Dodds, one could see a very bright future for them. That a hundred or so of them have come into existence within three or four years almost certainly proves that there was room for farmers to get together to bulk and select their produce with a view to quality and uniformity, and to sell collectively on better terms.

But there remain several unanswered questions about these groups. What scope is there for them outside fatstock and horticulture, where they are now most numerous? Will they be capable of lasting as commercial concerns and be large enough to carry the expenses of salaries, staff and premises? Do they merely cream off the best of the market for the benefit of their promoters and at the expense of non-participants?

To raise these questions is not to imply an unfavourable answer in each case. Selling groups will no doubt somehow or other solve the problem of ensuring commercial self-discipline without becoming separate commercial entities that trade *with* rather than *for* their members. There is scope enough for their development in fatstock and horticulture, even without at the present time much extension into cereals, eggs and potatoes. Nor are the initiatives of the more collectively-minded farmers to be condemned because they are playing their own hands.

Pause for thought

Probably the fairest assessment at the moment is that the continued growth of new selling groups at the hectic pace of the last few years might be a little dangerous, that a period of self-appraisal and consolidation is now called for, but that after that there seem to be many reasons why the selling groups should again stride ahead.

Support for this last conclusion comes from the article by Mr. Wade, which is of interest from several points of view. His commendation of farmers' selling groups does not appear to depend essentially on their being linked with a large and well-established co-operative society, though as the General Manager of one of them, that is naturally something he prefers. His support is also significant as coming from one whose own reputation as a business man is of the highest, and who would not be deceived by a passing fashion.

Mr. McClelland's interests and forecasts seem to lead in the same direction. After demonstrating why in his view the continuing and rapid growth of the supermarket method of retail selling cannot and should not be retarded, he points to farmers' groups as one of the more important sources of supply of those qualities and descriptions of produce which supermarkets require for their efficient operation and to give the best service to the public. If, indeed, retailing by supermarkets, multiples and co-operative shops comes to account for something like half the trade in farm produce, their special

requirements, mainly for repeatable lines of fresh produce of medium-high quality in large lots, will be something that farmers dare ignore only at their peril.

Local or national?

On the other hand Mr. Houston, with his apparent preference for monolithic organizations, no doubt considers farmers' groups to be rather small beer. Other advocates of statutory marketing boards, for fatstock or cereals, no doubt take the same view.

Mr. Rhys Thomas in a sense bridges the gap between local and national action, and between the principles of voluntary and compulsory organization, in so far as he sees all the individual selling groups as forming part of, or closely linked to, a single national trading body (Agricultural Central Trading Ltd.) which would be of near-universal scope, though not possessed of compulsory powers. On the fatstock side, a similar role of major wholesaler has been sought by the Fatstock Marketing Corporation.

Another possible variety of farmers' organization, of which more may be heard in the future, would be one concerned with developing (though not necessarily being party to) contracts between buyers and sellers. Such an organization would be concerned with promoting the use of forward contracts of link sellers, who might be either individual farmers or groups, with wholesale buyers, and these contracts would have to be reasonably precise (though not necessarily rigid) in specifying amounts, types, qualities and delivery dates. Whether the organization merely designed specimen contracts and then registered them, or itself offered to buy or to sell on contract, or did some of both, would no doubt depend on the commodity in question.

The assumed immediate advantages to the seller and buyer are those of having a known outlet or a known source of supply, as the case may be, for known produce.

For the marketing system as a whole, the case for such arrangements is that the requirements of the market would be signalled back to producers in an unmistakable form, and that the normal risk of the market would be reduced overall through the marriage and cancelling out of opposite risks.

The chosen instrument

From the viewpoint of public policy, whether or not to confer statutory powers on any body, or support it by public funds, are the issues which need to be faced first, because any body which enjoyed either of these would necessarily be a chosen instrument endowed with almost exclusive rights, and it would then have considerable power to impose its views on the rest of the trade.

Those who recoil from any such sweeping solution will no doubt argue that, as the previous articles have demonstrated, many and varied forms of free-market selling methods and systems are possible and desirable, ranging from the individual farmer at the one extreme to very substantial organizations like West Cumberland Farmers, the Fatstock Marketing Corporation, or Agricultural Central Trading Ltd.; and that the public and the farmers will in the end be best served if all these methods and systems, and possibly new ones, are allowed to fight it out among themselves, so exposing the claims for each to the test of commercial success.

The Report of the Verdon-Smith Committee seems on the whole to support this conception as regards the marketing of fatstock and meat, since although it proposes the setting up of a Fatstock Marketing Authority, the functions of this would be to facilitate trading rather than supersede any of the existing forms of trade, which would continue to compete as they now do.

Matching the mood of the moment

The articles in this series have brought out very clearly that we are in the midst of quite rapid change. We have seen developments from the growth of supermarkets and other large buyers at one end of the marketing chain, and at the other end various methods by which producers can provide the quantities, quality and regularity of delivery which these developing outlets require. As Mr. Dodds has pointed out, the trying out of many of these latter methods has been helped by grants under the Market Development Scheme.

There may well be still other methods or variations of existing methods worth trying out, and producer organizations will know that one of the purposes of the Scheme is to encourage and support experimental and pioneering ventures. In this respect the Market Development Scheme seems to be matching the mood of the moment among farmers and traders, who seem to be more aware of the opportunities and inevitability of marketing changes than for many years past.

MARKETING TODAY

The articles which comprised this series were:

A Farmer in Business	by Bryan Platt	October 1963
Marketing Boards	by George Houston	November 1963
Help for New Ideas in Marketing	by Pat Dodds	December 1963
The Distributor's Viewpoint	by W. G. McClelland and R. Nicholson	January 1964
Top Quality Weaners	by David S. Downey	February 1964
Co-operation in Practice	by J. C. Wade	March 1964
Veal and Eggs	by G. A. Mansfield and A. A. Eastwood	April 1964
Group Trading	by J. Rhys Thomas	June 1964

The 350–400 strong recorded pig herd at the Staffordshire Farm Institute is run on strict commercial lines, while at the same time providing a unit of teaching.

Something of its development and modern management is described by the VICE-PRINCIPAL

J. C. Matthews

The Rodbaston Large Whites

RODBASTON'S herd of Large White pigs was established in 1920. Its chief purpose is to provide satisfactory practical instruction in pig husbandry to students attending courses at the Staffordshire Farm Institute. It is therefore run primarily as a commercial unit embracing all aspects of practical management and husbandry, including pedigree breeding. At times the dual objectives of education and economic importance may conflict, but the main purpose of education at Farm Institute level must always be the training of efficient potential farmers.

A sale of in-pig gilts and young boars is held every year. At first sight this may not appear to have much to do with the training of students, but in fact it is a target for the whole enterprise which also gives a greater opportunity for experience in the management and selection of breeding stock and the practical use of records. The herd has been recorded continuously since the mid-1930s.

With the reintroduction of bacon grading, more pigs were carried through to bacon weight, and it soon became apparent that because of virus pneumonia accurate selection for growth rate and carcass quality would be impossible. The fattening accommodation was modified without much success until steps were taken to eradicate the disease.

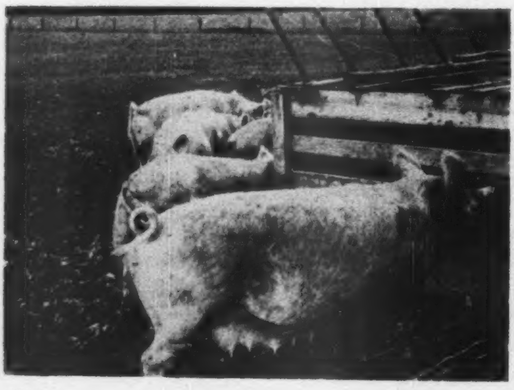
Eradication of virus pneumonia

Starting in August, 1955, the best old sows were farrowed in isolation in fold units, and eventually a virus pneumonia-free section of the herd was built up from four of these old sows, members of the Beautiful, East Lass and Maple families. At that time there were very few herds in the country which could justly claim freedom from the disease and therefore the purchase of replacement boars became a difficult problem. At first, infected boars were used with a special service crate, and later a number of home-bred virus-free boars became available. Now, thanks to the increase in the number of herds complying with the standards laid down by the Pig Health Control Association coupled with the use of artificial insemination and hysterectomy, it is possible to obtain sons of progeny-tested boars from sound blood lines. The last of the infected herd was finally disposed of in June, 1960, and the virus pneumonia-free section has complied with the standards for the A list of the Pig Health Control Association since December, 1962.

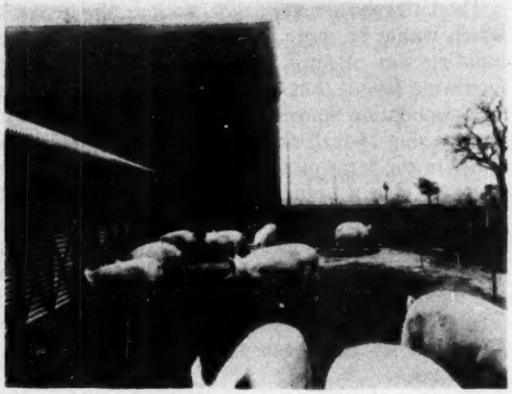
The majority of the stock boars used in the herd have been progeny tested with average results. Those in use at present are the sons of boars whose results were above average, particularly in lean meat percentage and food conversion and are themselves being progeny tested.

Sows and their litters

Originally, the breeding pigs were housed in large airy loose boxes with no insulation. The permanent grass runs had been in use for many years and were thoroughly pig-sick. In 1954, with the introduction of National Pig Records, it became obvious that rearing results were not good enough. It would have been very expensive to improve all the existing pens used for this purpose, so a few pens were modified for farrowing and the litters taken outdoors into straw bale huts at one week old.



This picture of in-pig sows at Rodbaston shows the individual feeders and the method of fencing



Breeding gilts at exercise outside the Solari house

The sows are enclosed by a single strand mains electric fence and the outside perimeter of the rearing area by pig wire or 18-inch sheep wire strained tight by Mills fencers and supported by angle-iron stakes at twelve-yard intervals. Since litters are taken outside all the year round, creep feeding in the hut is almost essential. A Norfolk creep is fitted in the back of each hut and proprietary pellets are offered from the time the pigs go out. Water is laid on to convenient points by polythene tubing, but has to be carted for a short period in very frosty weather. The dry sows have been housed outside in simple shelters for many years. Individual feeders, introduced in 1956, are considered to be essential.

Last year we modified the building used to house the sale gilts by dividing it into five pens, each fitted at the back with a kennel large enough for 15 gilts. Thirty front-opening individual feeders in two banks of 15 were installed on a raised feeding area in front, each bank serving two or three yards. We housed a number of dry sows here for the first time this winter. They received half a pound of food less per day than those outside, but it is too early yet to say whether there has been any change in their litters as a result.

Following the modern tendency, rations for suckling sows have been slightly increased and correspondingly reduced for the dry sows. Suckling sows are now being fed 6 lb plus 1 lb for each pig in the litter, and dry sows outdoors 6½ lb for the first and last month and 5½ lb for the middle two months. In spite of the extra food given during suckling, the dry sows still appear to need additional food for the first month to regain a reasonable condition. Again, it is too early to come to any conclusion, but it seems that there are more pigs alive at birth, although the total weight of the litter at birth has changed very little.

Modified Solari fattening house

When the virus pneumonia-infected herd was finally disposed of in 1960, a modified Solari fattening house was built to replace the old Danish-type house and loose boxes. This has the usual Solari 12-inch doorway, deep dunging area and 3 ft headroom in the kennels on one side of the central feeding passage. On the other side there is a lower sleeping area, giving 3 ft 9 in. headroom in the kennel, an 18-inch doorway and opening gates for daily cleaning out.

The latter modification was made both to save straw and to provide pens which would be more suitable for breeding animals of all ages. When this building was planned in 1959 there were so many opinions on the ideal farrowing layout that it was decided not to build any permanent farrowing accommodation immediately. Instead, temporary farrowing furniture was made, using 1¼-inch rails and kee clamps. This can be fitted into most pens, either in the form of a farrowing crate or as a creep with one rail 2 ft 6 in. away to give a voluntary farrowing arrangement. Both layouts have the advantage of being completely adjustable, have no wooden floor (which would be difficult to clean), and can be fitted into pens of any size or shape. Thus it has been possible to move the farrowing quarters to various pens in the buildings, giving the pens more rest between farrowings to keep down infection. Also it is considerably cheaper than most movable crates on the market. They have been used very successfully in the modified side of the Solari house.

Slats have been tried as an alternative to straw in the deep-dunging side of the Solari house. These consist of weldmesh panels 10 gauge 3 in. × ½ in. mesh for pigs up to 100 lb and 5 gauge 3 in. × ⅝ in. from 100 lb to bacon weight. The larger mesh has proved very satisfactory but the smaller requires more support and is too springy. We are now trying the smaller mesh with 10 gauge rods ½ in. apart, and 5 gauge rods 3 in. apart to give more support, and this is working out quite satisfactorily. We are also using one panel which is 5 gauge, with a mesh intermediate between those previously mentioned. If successful this could be used all the way through, from weaning to slaughter. We have considered using concrete slats, but they would be costly, bearing in mind that the dunging area in a Solari house is 6 ft × 7 ft.

Home-mixed feeds

With the exception of creep feed, all rations are home mixed. Copper is included for the bacon pigs, so a separate ration is used for breeding stock over bacon weight. The rations being fed at the moment are:

		New ration	
	Breeding stock	*Rearing*	*Finishing*
	cwt	*cwt*	*cwt*
Barley	14¾	10¾	12¾
Flaked maize	—	1	—
Weatings	—	5	5
Bran	2	—	—
Soya bean meal	1	1½	1½
Fish meal	2	1½	½
Vitamin mineral supp.	¼	¼	¼
	20	20	20

The weatings in the ration were increased about nine months ago, replacing barley or maize. The maximum quantity of meal fed per day previously had been 5¼ lb. This has now been increased to 6¼ lb, which has resulted in a great improvement in the age to slaughter without any marked effect on the grading. It remains to be seen what effect it will have on the final cost per lb liveweight increase.

At present, the majority of pigs not kept for breeding or sent for progeny testing are sold for bacon on contract. The few which are lagging behind at 140 lb live weight are culled for pork.

SUMMARY OF HERD RESULTS RECORDED BY PIDA

Litter Recording, April 1959 to September 1963

Average pigs per litter			*Total weight*		*Grading*			
Born	3 wks	8 wks	3 wks	8 wks	Age	Length	%AA +	%AA
11·5	9·3	9·1	115	361	194	805	56	15

Food Recording

	Breeding stock Food cost per pig reared	*Rearing stock Cost per lb liveweight gain*
	£ s. d.	d.
October 1962 to March 1963	2 18 7	11
April 1963 to Sept. 1963	2 18 3½	10½

PIDA comparison

	£ s. d.	s. d.
Good	2 15 0	10
Average	3 5 0	1 0
Poor	3 15 0	1 2

PROGENY TESTING DETAILS

Boars used in the herd

	*OLD RATING						†NEW RATING			
							Rating			
	Daily gain on test	Food conversion	Back fat average	Length	Eye muscle area	Carcass conf.	% Lean meat	Feed efficiency	Depth (mm)	Length (mm)
A	4	2	2	4	1	3				
B	5	5	2	2	3	3				
C	4	3	3	5	1	3				
D	2	1	2	5	1	2				
E	4	3	2	5	2	3				
F	5	3	4	5	3	4				
Sires of Present Stock Boars										
A	5	3	1	2	1	2	2	2	324	811
B	4	2	1	1	4	1	1	2	319	818
C	3	1	1	1	1	1	1	1	319	830

**Old Rating*

1, 2 above average
3 average
4, 5 below average

†New Rating

1, 2 above average
3, 4 below average
compared with the contemporary breed average

These figures indicate that the boars used in the earlier stages of the testing programme were breeding better than the average of tested pigs for eye muscle area and back fat thickness, about average for food conversion and carcass conformation and below average for length and daily gain.

J. C. Matthews, N.D.A., N.D.D., spent two years in the Agricultural Economics Department of Manchester University before joining the Staffordshire Farm Institute, at Rodbaston, in 1939 as Warden and Lecturer in Dairying. After serving in the Royal Armoured Corps during the war, he returned to the Institute in 1945 to take up his present position of Vice-Principal.

Poor milking reduces yields. And many authorities believe that faulty milking machines can predispose the udder to mastitis attack

Milking Machines at Fault

J. Hutchison

NINE out of ten milking plants are inefficient in some respect. This conclusion by N.A.A.S. Milk Production Officers who have for several years been looking into the mechanical efficiency of milking machines, is startling, to say the least of it. What effect this inefficiency has on time taken to milk, yield and udder health is largely a matter of opinion, but even on a modest estimate it must be considerable.

A milking machine can be divided into two parts. First, a pipeline system in which a partial vacuum is created; this is basically the same for all types and makes of milking machine, differing only in size and minor detail. The second part is the milking unit, which can either be a simple bucket unit with pneumatic pulsator, with which every dairy farmer is familiar, or something much more complicated such as is installed in a parlour or round-the-shed milking plant. For the purpose of testing, the two parts are dealt with separately.

Vacuum system

There are three basic working parts in all milking machine vacuum systems. (1) The vacuum pump, which extracts air from the pipeline. This is protected by a sanitary trap that prevents liquid, which may accidentally get into the pipeline, from reaching the pump. (2) The vacuum regulator, which controls the vacuum at the recommended level, often 15 inches of mercury. (3) A vacuum gauge, installed in the pipeline to measure the vacuum level.

The purpose of testing this part of the plant is to find out whether or not the recommended vacuum level can be maintained during a normal milking routine—essential for efficient milking. If there are serious variations the test will indicate the cause. In 73 per cent of the plants examined the vacuum level showed serious variation. An analysis of the causes is interesting. In 28 per cent of the plants examined the variations in vacuum level were due entirely to a faulty vacuum regulator. This is a matter which is easily put right; even its complete renewal costs only a few pounds. The pump was the cause of trouble in 30 per cent of plants. This, of course, is a much more expensive matter to deal with. About half of these pumps were too small and required renewal of both pump and motor, as a larger pump would be required. In the other half the pumps were inefficient, and renewal or complete overhaul was necessary, although a new motor would not be required. A small number of plants had excessive leaks in the pipe or other parts of the plant which were responsible for the variation in vacuum level and, although important in individual cases, amounted to only about 5 per cent of the total.

Easy check and maintenance

Fortunately, it is easy to establish whether or not the vacuum system is working properly. Before attempting to do this, the vacuum gauge must be checked for accuracy. It is worth while buying a new reliable vacuum gauge and keeping it for checking purposes. When the vacuum pump is switched on the vacuum should rise quickly to the recommended level. It should remain steady on this point throughout milking. Only minor variations of one inch or so of mercury can be tolerated, provided recovery is within a few seconds. Any vacuum system which behaves in this way is satisfactory.

Although it is easy to detect a faulty system, it is not such an easy matter to locate the cause; expert advice will probably be needed.

If the pump is well maintained in accordance with the manufacturer's instructions it will last for years. The most likely places for leaks to develop in the pipeline are the drain valves and taps. These should be cleaned and maintained regularly. Drain valves should be inspected monthly and taps dismantled at least once a year for cleaning and checking. The vacuum regulator should be cleaned thoroughly once a month, removing all traces of oil and deposits.

Milking unit

The milking unit consists of the teat-cup cluster, the milk receiving vessel (either a bucket, glass jar or pipeline) and the pulsation system. The tests on this part of the plant are confined mainly to checking the pulsation system for speed and ratio. The speed at which most pulsators are supposed to operate is about 60 pulsations per minute. It is essential that all the pulsators in a plant run at the same speed, since a cow will not always be milked by the same unit and variations in the speed of pulsation from one milking to the next are likely to upset the cow and interfere with milk let-down. Too slow or too fast a pulsation is undesirable, and in fact a very fast speed may cause the pulsator to work imperfectly. Seventeen per cent of the plants examined had one or more pulsators running at unsuitable speeds, i.e., under 40 or over 70 pulsations per minute. Some pulsators will not run except at excessive speeds. These require a complete overhaul and should be returned to the makers for this purpose.

The ratio of the pulsator is also checked. The pulsation cycle is divided into two parts: the milking phase when the liner is open and the non-milking phase when the liner is collapsed round the teat. The comparison between the length of these two phases is known as the pulsation ratio. A close ratio pulsator has a ratio of 1 : 1—that is, the milking and non-milking phases are of the same length. To increase the speed of milking, the milking phase in some pulsators is advanced at the expense of the non-milking phase. Such wide ratio pulsators have a ratio of over 2 : 1. None of the pulsators on the market has a ratio of over 4 : 1 if properly adjusted. Seventeen per cent of the tests showed one or more pulsators with ratios either less than 1 : 1 or over 4 : 1.

Checking and maintenance of pulsator

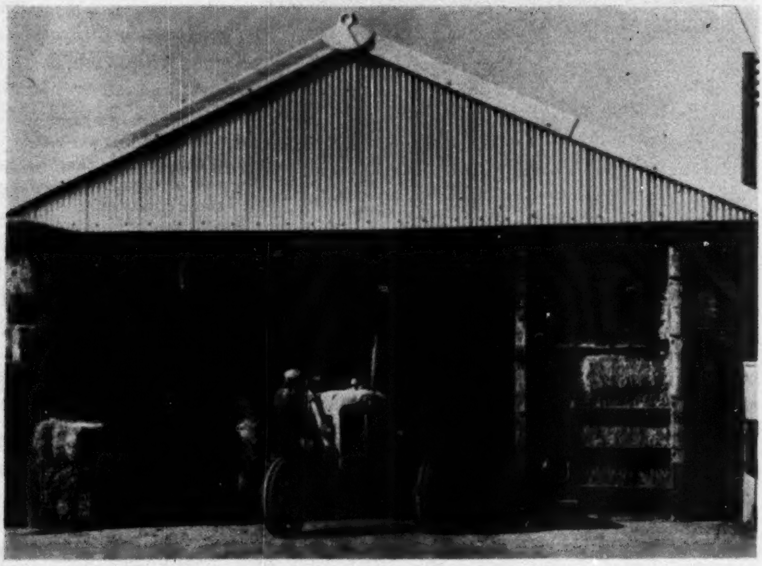
The only method of checking available on the farm is to plug three of the teat-cups with suitable bungs and insert the thumb in the fourth. When doing this it is essential to make sure that all the teat-cups are in the milking position. In this way the number of pulses per minute can be counted accurately and some idea of the pulsation ratio obtained. Variations in ratio between units or between the sides of two-sided pulsators can be readily spotted in this way. This method should not be despised because of its simplicity. With a little practice it is possible to identify many of the major faults that occur in the pulsation system. In 23 per cent of the plants using two-sided pulsators, there was at least one unit in which the difference in ratio from side to side was sufficiently different to affect the rate of milking of the two sides of the udder.

The great majority of the faults found were due either to excessive speed or dirt. Dirt blocks the gauzes and small ports in the pulsator, and produces an abnormal pulse. It is essential that pulsators be adjusted for speed at least weekly and that one or more of them be stripped down and thoroughly cleaned. The speed of master pulsation systems does not usually vary very much, but regular cleaning of these systems, whether they are electrical or pneumatic, is essential.

Farmers who have had their milking machines properly checked have shown keen interest in the subject. It is hoped that manufacturers of milking machines will soon be able to offer a proper testing service to their customers. If they do and farmers' interest in this matter can be maintained, a great improvement in the state of milking machines should result. Servicing schemes which have been tried in the past have failed, largely due to the fact that no definite evidence was presented to the farmer showing exactly what the faults in their machines were.

J. Hutchison is Regional Milk Production Adviser in the East Midlands Region of the National Agricultural Advisory Service. He and his colleague, **Mrs. M. E. Vale**, have been largely responsible for the pioneer work on mechanical efficiency of milking machines.

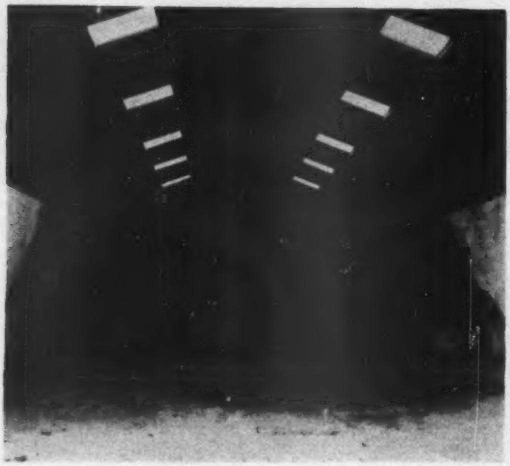
New buildings or old, Michael Tilley shows how to get the most out of your potato storage



A timber-framed building converted to a potato store with a fence lined with straw bales. The doorway is closed with stout timbers, lined with the bales stacked on the left

Stores for Ware Potatoes

WARE potatoes can be stored practically anywhere. After all, for generations they have been stored in the open, covered by nothing more than a layer of straw and mother earth. These clamps, or graves, look deceptively simple, but their building and management require considerable skill. This is not the sort of skill you can read about in text-books or articles: it is a very localized knowledge handed down from one generation to another. It is probably for this reason that it tends to be ignored by those who have gone in for storing their potatoes in buildings. And this is why many farmers have come unstuck with indoor storage of potatoes.



The interior of a purpose-built store. The walls are of reinforced brickwork, with corrugated sheeting above potato storage level

The old skills are not, of course, directly applicable to the new sort of storage. New skills must take their place. This article therefore sets out some of the background against which the old skills were developed so that a farmer, thinking about indoor storage, can take over where the previous generation left off. He can adapt his buildings and management skills to get the most out of indoor storage. It also mentions some of the more common pitfalls peculiar to indoor storage.

Capacity of the store

Firstly the matter of bulk and weight. Potatoes occupy between 54 and 56 cubic ft per ton stored, so it is possible to take the length, breadth and storage height of any building in feet, multiply these together and divide by 56 to give the capacity of the building in tons. For an unventilated store, the store height should not exceed 8 ft. For a ventilated store, the height can be increased to 12 ft. Generally speaking, the deeper the potatoes are stored, up to a maximum of 12 ft, the better will they keep, provided there is adequate control of temperature and so sprouting.

When it is proposed to convert an existing building to potato storage, the storage height may well be governed by the building itself. Where tie beams and roof trusses get in the way, the level storage height should be calculated on a level at least 3 ft below the bottom of the tie beam or truss. This is to allow the elevator sufficient room to manoeuvre. Where there is a flat ceiling, the storage height should be at least 6 ft below ceiling height, to allow sufficient air to draw over the stack for cooling. Tipping trailers cannot be used easily in a building with a height of less than 11 ft from floor to ceiling. For quick turn round the door height should also be made 11 ft. Ideally the store should provide a free space at one end of at least 20 ft long, so that cleaning and grading can be started under cover and bagged-up potatoes stored close at hand.

The floor can well be of earth. A concrete floor adds considerably to the capital cost and may increase the risk of damage to the potatoes. It does,

however, provide cleaner, easier and less dusty conditions. The thresholds of all doors should be concreted.

Walls to withstand thrust

Potatoes stored in bulk exert a considerable sideways thrust on the walls used to support them. Various formulas are available to work out the exact thrust, but a good working rule of thumb is to assume a sideways thrust of 10 lb per foot run for each foot depth of potatoes. Thus a 12-ft high stack of potatoes will exert a sideways thrust on a wall 15 ft long of $10 \times 12 \times 15 = 1{,}800$ lb. The thrust is spread over the entire wall and is obviously greater at the bottom than at the top. It may be assumed that the point of maximum pressure is about one-third of the way up the stack, or 4 ft above floor level in a stack 12 ft high.

What sort of wall will withstand this thrust? A new permanent wall should be built of 9-inch brickwork reinforced in every other bed joint with wire-mesh. Higher up the wall, where the thrust is less, this reinforcement can be reduced to every fourth or sixth course. Brick piers, or a means of tying the brickwork substantially to the uprights of a frame building, should be provided about every 12 ft. The thrust taken by these walls and piers will, in the ultimate, be transmitted to the ground, so care must be taken to make sure that they are built on sound and solid foundations.

Temporary walls

A temporary wall can be built to convert say a Dutch barn or covered yard by building two layers of straw bales and backing them, on the outside, by a substantial fence built of old railway sleepers spaced about 7 ft 6 in. apart and let at least 3 ft into the ground. These can have 4 in. × 2 in. rails spaced about 2 ft to 2 ft 3 in. apart. The bales will take up a fair amount of room inside the barn and, compared with the brick wall, the whole thing may seem rather substantial, but unlike the brick wall, which is only 9 in. thick, it relies on its width for its strength.

Loading a store direct from pallet boxes by means of a special hydraulic arm. Straw bales have been placed along the top of the A duct temporarily, to prevent the potatoes spilling forward and being crushed by the tractor wheels

Keeping out the frost

Stores must be frost-proof. Potatoes can be damaged by frost in two ways, apart from the obvious one of ventilating them with freezing air. They will be damaged by contact freezing if they lie against a wall which is not sufficiently insulated to prevent frost from striking through it. In most cases a layer of straw bales, which take up a lot of room, or a 2-inch thick slab of wood-wool or compressed straw is sufficient to prevent this. In the straw bale and fence wall great care must be taken to pack and bond the straw bales tightly together. This gives the wall strength and also prevents frost-laden air from blowing through it.

Convective frost damage, which is frequently mistaken for damage by contact freezing, is caused by the very heat given off by the potatoes themselves. This heat causes the air in the stack to rise. The heat is greatest in the centre of the stack, so the air rises more quickly here and is replaced by air drawn down the outsides of the stack. Above stack level this moving air will come into contact with the roof and, during prolonged spells of cold weather, the general store temperature may drop so low that the air, on touching the freezing roof, may become frost-laden and so may damage the potatoes when drawn down the outside of the stack.

To prevent this, the roof may be lightly insulated, though some farmers have prevented trouble by laying a physical barrier to the cold air, in the form of a sheet of polythene some 4–5 ft wide down either side of the stack on top of the potatoes. But this is a doubtful cure and requires careful management, since it leads to damp potatoes due to sweating on the underside of the polythene. For this reason it can be only left in position for a short while.

The sugar content of potatoes sold for chipping and crisps is of critical importance. The sugar content depends on the temperature at which the potatoes are stored and rises sharply if the store temperature drops much below 50°F. At this temperature sprouting must be suppressed chemically and the store temperature kept as near as possible to 50°F to reduce the need for excessive application of sprout suppressant. It will probably be necessary to insulate the store rather more heavily to ensure that during cold weather the store temperature does not drop too low.

Loss of moisture

Stored potatoes give off a considerable amount of heat. Unless the heat is dissipated by convective or forced draught air currents, it will be sufficient to make the potatoes sprout. With most varieties, the temperature must be kept below 40°F to prevent sprouting, unless chemical suppressants are used. The air which is used to keep the store temperature low will also remove moisture from the potatoes. Just after they have been lifted and stored, and before their wounds are healed or their skins thickened, the amount of weight which can be lost in this way is considerable. After about the first fortnight the skin controls the rate of water evaporation, which is then very much reduced.

It might be thought that the amount of moisture taken away by the ventilating air depended on three things, the amount of air used, its relative humidity, and the length of time during which ventilation takes place. In practice it has been found that the amount of air has little effect on the evaporation, except at a very low level of ventilation indeed. As the store

temperature will depend on the amount of air used and its temperature, it follows that to get maximum temperature control with minimum evaporation it is best to blow large quantities of cold air through the stack for a short period rather than lesser quantities for a long period.

Forced draught ventilation

The old recommendation for forced draught ventilation used to be 40 c.f.m. per ton stored. Many Continental farmers have now increased this to 65 or even 80 c.f.m. per ton. This can only be done by increasing the duct sizes and using larger and more powerful fans. It also greatly increases the fan power requirements. These can be kept within reasonable limits by arranging the ducting and air valves so that selective blowing can be directed to a part of the store only. In this way a fan capable of ventilating say only one-fifth or one-quarter of the store may be adequate, and considerably cheaper than one capable of ventilating the whole store at once.

If an hygrometer can be used to keep an eye on the relative humidity of the air as well, and the store ventilated only at times of high relative humidity and low temperature, then evaporation can be reduced to a minimum. This may sound rather complicated and expensive and hardly worth bothering about, but if it keeps your potatoes in good saleable condition, it is an exercise well worth considering.

Michael Floyd Tilley, A.R.I.B.A., A.I.H.V.E., comes of Northampton farming stock. He joined the Ministry's Agricultural Land Service at Cambridge in 1953, after earlier experience in private practice and with Local Authorities. He is now Senior Assistant Land Commissioner, stationed in London.

Bought concentrates or do-it-yourself?

P. J. Stone

N.A.A.S. LIVESTOCK OFFICER

BARNSTAPLE

puts the case. The verdict is yours

A Mixed Blessing

How much are you paying out on your feed bill, and what returns are you getting? For intensively fed beef and pigs, the proportion of feed costs to total inputs can be as high as 80 per cent. With dairying it is less but can approach 60 per cent, according to the system employed. We can weigh the relative merits of purchased compounds against those of home mixing of concentrate rations, but the acid test all the time is the effectiveness shown by the final product. Thus a bacon ration of £30 per ton can be more profitable than one costing £28 if it produces 1 lb of liveweight gain more cheaply.

To press the point further with pigs, one must think in terms of the cost of food to produce one pound of lean meat. Breeding is a primary influence here, but the composition of the ration has a marked effect on the lean : fat ratio. An animal housed and fed intensively can respond only within the limits of its breeding and management. No other source of nutrient is available

to supplement a possible deficiency. Hence the need not only for balance between protein and starch, but that each should be correct in quality and composition. To these must be added supplements of vitamins and minerals (and possibly antibiotics) in critical amounts, to be evenly incorporated throughout the bulk of the mix.

The case for purchased compounds

Manufacturers of compound concentrates lay great emphasis on the importance of the foregoing points. Justly so. They state that their knowledge and experience can produce a more effective ration—though possibly, weight for weight, more expensive. Extensive research in nutrition is carried on, not only by national concerns, but also by the smaller local companies, and as a result of this and other progress it is doubtful if financially significant advances can be made beyond what is at present being achieved. What can be done is to raise an average efficiency that is too low to a safe level that will survive a further fall in returns.

Having suggested that the manufactured compound is relatively more expensive that the home-produced article, it is fair to point out that severe price fluctuations of ingredients are not always reflected in the final price. This permits the livestock producer to budget with reasonable confidence. It is not necessarily correct to assume that compounds are closely tied to the price of English feed grains. Partly by reason of bulk purchase from overseas suppliers and partly from the advantages accruing from modern manufacturing techniques, substantial benefits can be and are passed on to the farmer. Another intangible benefit here is the feeling of confidence which the consumer has for a nationally advertised article. A certain amount of anxiety is removed from his business, and for this assurance he is quite willing to pay a little extra.

Not all stockmen are conscious of the need for accuracy when preparing concentrate mixes. With creep and other feeds having additives in critical proportions, it is obviously sensible to buy the manufactured product.

Home-mixing enthusiasts do not always realize that weight can be lost in the milling process. This varies with the moisture content of the grain and the method of processing. Hammer milling of 18–19 per cent moisture grain can lose 5 per cent by evaporation—and that is one cwt per ton! Similar corn put through a roller mill would be barely affected. Obviously, the important factor is the initial price paid for the grain, but it is worth remembering the net benefit of buying a compounded food.

Important too are the allowances which come with buying in quantity. These, in addition to discounts for prompt settlement, can give a net saving of £2 per ton. And, curiously enough, most farmers will agree that bought concentrates tend to be more accurately rationed. The farmer should always critically examine the product he is buying. One hears reports of cheaper compounds which ultimately prove to be more expensive.

Is cubing necessary? Certainly, it is not essential, but concentrates in cube form have advantages. Cows in parlours can eat them quicker—sows at pasture can eat them all. Floor-fed pigs cough less, and, not surprisingly, put on a little more flesh. But farm cubing is an expensive process—as much as 50*s*. per ton extra, which more than offsets the benefits. Not so with big concerns, where the very scale of operation reduces unit costs.

The success of a farming business must be measured by the return on invested capital. Where a man finds himself under-capitalized and under-stocked, additional capital will be more profitably invested in more stock. In this way the business can expand. Cows and pigs show a quick return and millers' bills can be met by sales.

Doing it yourself

The various situations previously described apply to the majority of livestock farmers. Limitations of capital, labour and knowledge dictate their feeding programmes. The brightly-coloured bag glaringly assures the purchaser of the reliability of its contents. But sooner or later the operator must take a long, hard look at the structure of his costs, and decide whether in fact some of the profit being justly made by his miller should not be going into his own pocket. Sooner or later? Why not sooner? It may be postulated that no livestock enterprise should be embarked upon that cannot justify the installation of grain storage (for, say, two month's supply) and appropriate processing machinery. It is not necessary to budget for a full twelve months. With most grain farmers, who have adequate storage anyway, direct forward buying is an obvious benefit for both parties.

What then is the minimum quantity of cereals/protein cake, etc., which profitably justifies home processing? Economists are agreed that 60 tons a year must be regarded as an absolute minimum. Further savings accrue as the quantity increases, with 100 tons as a safer minimum figure.

The feeding of bacon pigs can again illustrate this point. Assuming a properly designed set-up (it can be as cheap or cheaper than one which squanders labour), it is feasible for a competent man to produce 1,200 baconers a year, each consuming about 5½ cwt—a total feed bill, in fact, of some 330 tons. Here man and capital are fully employed, ensuring as far as possible maximum profit.

It looks too easy, you say, there must be snags. There are indeed, but try working it out any other way, and the problems increase. Where sufficient capital is available it must be good business to install storage and processing machinery *and* of such capacity as will permit further expansion. Let it be designed to use modern techniques of grain handling which can keep the labour charge as low as 3–4*s*. per ton.

What it costs

The initial cost of a unit capable of dealing with the quantities mentioned would be about £600, giving the following annual charges:

Depreciation 15%	£90	
Capital charge @ 6%	£36	(reducing by £5 4*s*. p.a.)
Maintenance	£40	
Total	£166	

Assuming an annual throughput of 330 tons as the example, the final charge per ton will not be more than ten shillings. Electricity will amount to 2*s*. 6*d*. approx., added to which is a labour charge of 4*s*.

Bearing in mind that the installation has a capacity exceeding 330 tons a year, a figure of 17*s*. per ton is acceptable for budgeting purposes.

Presenting the case for a home-mixed bacon ration at early 1964 prices of 'straights', the following figures emerge:

		£	s.	d.
Ground barley	10 cwt @ £23/ton	11	10	0
Wheat	6 cwt @ £25/ton	7	10	0
Middlings	2 cwt @ £26/ton	2	12	0
White fish meal	½ cwt @ £62 10*s*./ton	1	11	3
Soya bean meal	1½ cwt @ £50/ton	3	15	0
Minerals and vitamins	28 lb @ £1 1*s*.	1	1	0
Machinery charge	@ 17*s*./ton		17	0
	TOTAL WEIGHT (1 ton 0 cwt 28 lb)	28	16	3
	TOTAL COST per ton (incl. mins./vits.)	28	8	10

A purchased compound of comparable analysis would cost in the region of £31 per ton. The difference of £2 10*s*. per ton is a commonly accepted average figure. It is certainly not excessive, for the prudent operator will always keep the cereal market under close scrutiny. Do you remember wheat at £17 per ton in 1962 and barley even cheaper than this a few years ago? Further reductions in cost accompany increases in scale of operation. It is common sense that the state of the cereal market must influence the composition of the ration. Replacement of ingredients should be undertaken sensibly, and that means gradually. This is fundamental to the management of all forms of livestock, but home mixing does enable the home processor to fully control his feeding programme. Instances have occurred when fresh batches of manufactured feeds have been refused by stock. Condition can be lost quickly, and profit margins are pared a little more. Such incidents are rare, but they do remain a hazard with animals managed intensively.

Why turn away profit?

If there are barriers which prevent more farmers from fully controlling their feeding management they often appear to be psychological rather than physical or financial. It is so much easier to let someone else do the work and the thinking, which, after all, is a feature of our society. But this is an article dealing with a business issue, not a sortie into the realms of philosophy.

If it is physically and financially possible to earn another £800 a year on a pig enterprise, the question is whether one can afford to ignore it. During a spell of low market returns this can represent the entire profit; indeed it may not be as much as this. There can be no real disagreement that where the essential conditions of capital, labour, technical know-how and convenience are met, on-the-farm processing cannot fail to be a really important factor affecting profitability.

Two items from the 1964 report of the ANIMAL BREEDING RESEARCH ORGANISATION

Moulting in sheep

Cross-breeding in sheep and cattle

THE Animal Breeding Research Organisation's studies of moulting in sheep, besides having an important bearing on the economics of wool-growing, are providing new knowledge about the whole process of hair growth in mammals. Eventually they may bring a deeper understanding of normal and malignant growth processes in general.

In the Wiltshire Horn sheep the wool growth cycle culminates in patterned shedding of the whole fleece every spring. The lambs shed their birth coats when 2-4 months old, partly because they are then sufficiently mature but also because some necessary environmental factor then becomes operative. Apparently day-length, which governs the hair growth cycle in some animals, is not the only influence at work here. ABRO has demonstrated that Wiltshire lambs moult even when kept in constant, dim, artificial light, though in

This Southdown gimmer showed severe fleece shedding in May after being kept on a hill farm for part of the winter

such circumstances they moult less completely than control lambs exposed to naturally fluctuating day-length. Ambient temperature and nutrition may be contributory factors. ABRO's work has demonstrated that low-plane nutrition tends to retard and reduce the extent of fleece shedding in both young and adults of this breed.

In contrast, stress imposed by nutritional hardship and cold temperatures seems to induce moulting in other breeds. Hill sheep (Blackface and Cheviots) moult more extensively and more frequently after harsh weather. ABRO has even induced stress-moulting in Southdowns by keeping them on a hill farm for part of the winter. Moulting in Blackface and Cheviots may be a genetically conditioned failure to withstand environmental stress. Individual sheep differ in their susceptibility, hence against some forms of fleece-shedding, appropriate selection by the breeder may prove helpful.

Cross-breeding

ABRO's cross-breeding experiment with the Scottish Blackface and Swaledale breeds, recently completed, is noteworthy, for it provides the only reliable estimate so far available of heterosis in hill sheep. The first-cross ewes were heavier, produced more wool as hoggs and weaned more lambs as four-year-old ewes than either of the pure-breed ewes; and the cross-bred lambs, whether singles or twins, were heavier than the pure-bred lambs at weaning. The cross-bred lambs from Swaledale ewes were significantly heavier at birth and weaning than those from Blackface ewes.

The experimental flock had an above-average fertility and viability. ABRO suggests that under harsh conditions, where the general level of fertility is lower, the use of cross-bred ewes might increase lamb production and would probably improve lamb quality. Crossing distinct strains within the hill breeds might be a profitable way of exploiting heterosis without destroying breed character.

One argument in favour of cross-breeding is that it increases the number of live offspring. In an experiment with Holstein and Guernsey cattle at Illinois, U.S.A., cross-breeding reduced deaths or forced sale of young females up to calving age from about 21 per cent to 9 per cent. In a cross-breeding experiment with Friesian, Ayrshire and Jersey cattle at Cold Norton, Staffs, cross-breds have survived better than pure-breds—at least up to the age of about 3½ years (two calvings)—and suffered less from reproductive troubles.

Summarizing present evidence, ABRO suggests that in those breeds where losses of calves about the time of birth tend to be high (over 7 per cent), cross-breeding will often reduce them. Results so far available also tend to confirm the beneficial effects of cross-breeding on mortality later in life.

Sylvia Laverton

The report is available from H.M. Stationery Office, price 6*s*. 6*d*.

EIGHTY PER CENT of our celery crop, some 4,300 acres, is grown in East Anglia. Of this, 4,000 acres are in the fens, covered by Norfolk, Isle of Ely, West Suffolk, Cambridge and Huntingdon. Production on individual holdings varies from a few acres up to more than a hundred, and more often than not the crop is included as part of the farm rotation

Celery in East Anglia

K. V. Cramp

LARGE-SCALE commercial production of celery is to be found in this country in only two clearly-defined areas—both mainly on peat soils; predominantly in East Anglia and a much smaller area on the moss peats in Lancashire.

Celery thrives in a highly organic, free-rooting and consistently moist soil, and it is these conditions which the fen peats provide and encourage high yields and good quality. But good quality crops are also produced extensively on some of the light silts in Lincs (Holland), where up to 80 tons per acre of farmyard manure are incorporated into the soil before planting.

Intensively grown early crops of the self-bleaching varieties are grown on small holdings in various parts of the area, mainly on the lighter mineral soils, but the acreage is relatively small although yields per acre may be high.

Varieties come and go

Changes are continually taking place in the popularity of varieties as and when new introductions come on to the market. The non-self-bleaching

variety New Dwarf White is still the most widely grown and the best quality maincrop variety that we have. Self-bleaching varieties are grown to a limited extent on an extensive scale to come in before New Dwarf White. The more recently introduced self-bleaching variety Lathom Blanching is becoming very popular as a maincrop variety; it has a good appearance, is of quite good quality and seems to stand just as well as, if not better, than New Dwarf White. Later varieties are not grown to the same extent as in the past, due mainly to the fact that stocks of the variety Wareing's Dwarf White, formerly grown for later work, seem to have deteriorated considerably. Efforts are now being made to improve on this variety and the recently introduced Fenlander is certainly encouraging. Cambridge White, although rather on the short side, is proving to be a good variety on the best soils for later work but it will not tolerate poorer conditions.

Plant raising is a specialist's job, as the greater proportion of the crop is grown by farmers who have no facilities for plant raising and in any event do not want to be bothered with it. This being the case, most of the plants are raised by nurserymen in and around the small town of Whittlesey, near Peterborough. Recently, however, plant raising has spread to the parishes of Southery and Littleport, but Whittlesey still remains the largest plant-growing area. A number of nurserymen and many workers are employed in seed sowing under glass, pricking out into beds in the open and lifting the plants for transport to the fields.

The fen peat soils used for extensive celery growing vary considerably from deep, light immature peats to the more shallow mature types containing more mineral matter. Celery grown on the lighter, warmer peats tends to mature earlier and will not hold so well as that grown on the heavier and cooler types.

Manuring

Manurial practice varies considerably according to the type of peat and grower's preference. Growers who have farmyard manure available plough this under in the autumn at rates of up to 20 tons per acre. Experiments carried out by the N.A.A.S. in the Eastern Region have shown that on the light peats nitrogen did not increase yield and at higher rates resulted in a yield decrease. Phosphate and potash both increased yields, as did agricultural salt when broadcast at least a month before planting. In the light of these results a number of growers do not use nitrogen for this crop on the light peats but tend to follow the recommendations made by the N.A.A.S. to use 5 cwt superphosphate plus 5 cwt muriate of potash per acre broadcast before planting. Although 5 cwt per acre of agricultural salt gave some useful yield increases, growers are inclined to be afraid of its possible effect on succeeding crops such as potatoes. On the heavier and more mature peats some nitrogen is often used in the base fertilizer, but high rates are avoided. On the silt soils higher rates of nitrogen are of course used.

Planting by machine

Planting is now carried out almost entirely by machine and, provided the plants are graded and the machine is properly set, it does a better job than the average hand planting which is still carried out by some of the smaller growers. A recent method of growing adopted by a few of the smaller

Special high clearance tractors and ploughs with large mouldboards are used to earth-up the rows of celery for blanching

growers is to direct drill the seed in the rows and later chop out to 6 inches apart in the row. A good seedbed, great care and chemical weed control are necessary if this method is to be successful. If done well the resulting crop appears to be quite satisfactory, with a full stand of even-sized heads.

Deep planting is not good, for this checks growth and the resulting head has a long, solid neck at the base. Distances between the rows vary considerably, but 4½ feet is really necessary to allow for even moderate earthing-up of maincrop celery. Experiments on the spacing of plants in the rows carried out in the Eastern Region indicate that 6 inches is about the right distance from plant to plant, and this can be achieved by mechanical planters.

The self-bleaching varieties are usually grown at much closer spacings. Row widths of about 28 inches, similar to potatoes, will allow one light earthing to hold the leaf stalks together. Bed systems of growing, such as are practised under intensive systems, are also used extensively by some growers of self-bleaching celery. This increases the plant population considerably and eliminates the necessity for any earthing, reduces crater spot and the tendency to early maturity (pithiness) and gives cleaner heads.

Weed control has always been a problem on the fen peats and although it has been possible to keep down weeds by mechanical means in between the rows, close spacing in the rows has demanded a considerable amount of hand work. The more highly refined mineral oils have been used with success in seed and plant beds, and more recently C.I.P.C. has been used with success on plant beds after pricking out and when established. Residual herbicides such as C.I.P.C. are often most unsatisfactory on the light peats, but some success is reported by several growers with 'Linuron'.

Blanching the crop

Most of the machinery used in celery growing is specially made for the job by the grower or in conjunction with the local blacksmith. High clearance tractors are necessary and earthing-up is carried out by specially constructed moulders, capable of banking up the soil to the rows of plants. For short varieties early in the season, one banking may be sufficient, but for later varieties and later crops several may be necessary to keep out frost. As the operation of earthing-up tends to hasten maturity (pithiness) and to make the crop more liable to disorders such as crater spot, it is important to estimate future requirements of blanched celery for the market and to earth-up in

batches—according to estimated requirements. A period of at least three weeks is necessary to blanch the crop.

Leaf Spot (blight) can be a very serious problem, and it is usual to spray the growing crop several times, although the present practice of treating the seed with hot water has greatly reduced the need for routine spraying.

Lifting the crop is still mainly done by hand, although several large growers are developing home-designed mechanical lifters. As a rule the roots are loosened by mechanical methods, after which the heads are pulled out and rough trimmed in the field. In some instances the heads are properly trimmed in the field and packed straight into containers such as crates or cubes, the tops being trimmed off after packing by the use of a hay knife. Complete hand digging is rapidly disappearing.

Putting it on the market

Packing and grading is often carried out in the field but a number of growers transport the roughly trimmed celery to a central packing shed, where it is washed, trimmed and packed—usually in non-returnable containers. Several growers pre-pack for distribution to chain stores and supermarkets. As already indicated, some celery varieties such as New Dwarf White are very brittle and easily damaged. The black peat soil is very difficult to get rid of and most washing plants have a pre-soak tank where the soil is moistened and much of it removed before the heads enter the washer.

There are various types of washers incorporating strong jets of water which hit the celery heads as they pass through on the conveyors. With some makes, the heads pass through the washer on their sides, but in others each head is fixed upside down on a hook. The latter method gives a cleaner head, but each stick has to be handled and if the operators are not very careful the hook can damage the head. In some of the larger installations transport of the heads in the line is done by fluming in water. This helps to reduce damage, particularly to the heads of brittle varieties. After washing, a final trim is given and the heads are packed into wooden containers or pre-packed in suitable film before packing into containers for transportation.

Celery is also used by the processors for canning and soup-making. In the past the processors tended to take the smaller heads that were not suitable for market, but latterly the tendency has been for growers to contract with the processors for the whole crop.

Lifted celery heads are put into crates in the field and the surplus tops cut off with a hay knife

Cold storage a possibility

Cold storage of celery is a possibility, as a result of the work done by Hugh Smith at the Ditton Laboratory, and a few growers who have a range of other vegetables suitable for storage are putting up cold stores or taking space in existing stores. Provided the celery has been only rough trimmed and handled carefully, it is found that at a temperature of 32°F and a humidity of 95 per cent it will store quite well for eight weeks. After that time storage rots seem to appear very quickly, but with more careful handling and making sure that the heads are not over-mature before storage they may well keep longer.

Celery is an expensive crop to grow and more expense is incurred in grading, washing and packing. Like many other vegetable crops grown on a large scale, the proportion of top-grade produce must be high to make it worthwhile to grade and pack to a high standard. Having grown a good crop it must be handled with care and put on to the market in the most attractive manner possible.

As the N.A.A.S. Adviser on vegetable growing in the Eastern Region, **Mr. Cramp** has an intimate knowledge of the specialist cultivation of the celery crop.

The Ministry's Publications

Since the list published in the June, 1964, issue of *Agriculture* (p. 288) the following publications have been issued.

BULLETINS

No. 169. Diseases of Cattle (Revised) 5*s*. 6*d*. (by post 5*s*. 11*d*.)

Deals comprehensively with infectious diseases, breeding troubles, parasites, mineral deficiencies and excesses and metabolic disorders, and describes in detail causes, symptoms and control measures.

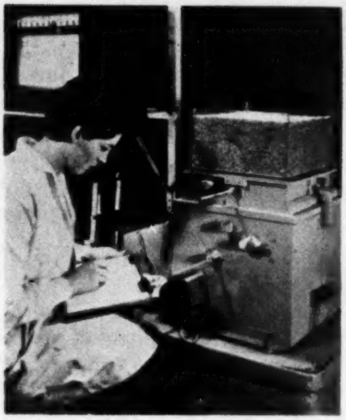
ADVISORY LEAFLETS

No. 99. Powdery Scab of Potatoes (Revised)

No. 109. Flea Beetles (Revised)

No. 427. Feeding Turkeys (Revised)

Single copies of Advisory Leaflets, up to a maximum of six different leaflets, may be obtained free from the Ministry (Publications), Government Buildings, Tolcarne Drive, Pinner, Middlesex. Copies beyond this limit must be bought from Government Bookshops (addresses on p. 348), price 4d. each (by post 7d.). Other publications are obtainable from Government Bookshops, from Divisional Offices of the Ministry or through any bookseller.



A grain-drying experiment in progress

The Drying of Feeding Wheat

THE disastrous results of using too high a temperature in the drying of milling wheat on baking quality are well known (E. N. Greer wrote about this subject in the August, 1963, issue of *Agriculture*). Clearly, the advice given to grain-drier operators in the Ministry's publications to use temperatures not exceeding 150°F for drying milling quality wheat is fully justified.

The position with wheat intended for animal feeding is not so clear. Damage to nutritive value, and particularly to protein quality, by high temperatures has been demonstrated for all kinds of foodstuffs, and to avoid the possibility it has been recommended that drying temperatures in excess of 180°F should be avoided. In recent years harvesting conditions in this country have sometimes been particularly poor; moisture contents of the grain have been high and grain driers have been operating for long hours to get the crop into a condition safe for storage. From some points of view, quicker drying would be advantageous, provided the nutritive value of the crops is unimpaired. Throughput can be increased most easily by raising the temperature of drying, and the question therefore arises how high a temperature can safely be used. Here, we are concerned with continuous flow and tray driers, since these are the ones that could be used at temperatures over 180°F.

With this problem in mind, we have collaborated in assessing the nutritive value of wheat samples dried under different conditions of time and temperature. The variety chosen was Koga II because, as a high protein wheat, it made the investigation of protein quality easier.

Four samples

The wheat was harvested at about 22 per cent moisture and allowed to dry out a little. It was divided into four samples, each of which was dried in the experimental grain drier at a bed depth of six inches without mixing during the runs. The treatments used and details of the initial and final moisture contents are shown in the first table.

Table 1

Sample	Inlet air temp. (°F)	Time	Moisture content (%) Initial	Final
1	80	30 hr	21·3	14·8
2	180	37 min	21·3	14·8
3	220	26 min	21·2	15·0
4	220	120 min	21·0	5·8

In runs 2 and 3 the grain was dried to a mean moisture content of about 15 per cent and only the bottom layer of grain was raised to a temperature near that of the inlet air. The temperature difference between the bottom and the top layer of grain at the end of run 3 at 220°F was 100°F. In the case of run 4, however, drying was continued (for experimental purposes) so that this difference had been reduced to 7°F. The second table shows how the temperatures in the grain bed differ between the various drying runs.

Table 2

Sample	Inlet temp. (°F)	Final temp. (°F) Top	Middle	Bottom
2	180	121	159	179
3	220	119	180	219
4	220	213	218	220

After drying, the samples were ground and allowed to equilibrate with atmospheric moisture.

Two feeding trials

Normally cereals provide the chief source of energy in diets, and the protein they contain is their second important contribution. Two kinds of feeding trials were carried out, using young growing cockerels as the experimental animals. Our first experiment was designed to compare the four samples as major components (about 65 per cent) of diets which contained 23 per cent crude protein, with adequate amounts of all the essential amino-acids and all other known nutrients. Growth and feed conversion were excellent for the breed used and there were no significant differences between the performances on the four diets.

Secondly, the quality of the four materials as the sole source of protein was compared. Wheat was included at a level of 87 per cent to supply 14·8 per cent of crude protein to diets adequate in all other known nutrients. Here, not surprisingly, growth and feed conversion were poor, but again there were no significant differences between the performances on the four diets.

We can conclude, therefore, that from the standpoints of protein feeding value, supply of energy and palatability, it was safe to dry wheat with air temperatures up to 220°F. Even two hours exposure to this temperature, though in fact excessively long for drying, had no adverse effect. It is conceivable that in practice a drier might be seriously maladjusted, and this possibility was the main reason for including the fourth treatment.

These results are in agreement with those from some work done in the U.S.A. on the drying of maize for feeding purposes. The use of temperatures up to 220–240°F has been shown to be without effect on the nutritive value of maize for young pigs, grower-finisher pigs, poultry or beef steers. It seems reasonable to suppose that for wheat, the results obtained for chicks could be extended to other types of livestock. We must emphasize, however, that these temperatures must not be used for milling wheat.

A full account of this work will be published elsewhere, but we hope that, should the conditions at the coming harvest time be bad, this summary will be of practical value.

C. K. MILNER, School of Agriculture, University of Cambridge
J. WOODFORDE, National Inst. of Agric. Engineering, Silsoe

Henry Sawyer

gives advice on keeping

Farm Roads in Good Repair

As a road was made, so will its life and upkeep be. The making, re-making or routine maintenance of a road must be done against a correct assessment of the relative basic factors, which are: subsoil, route (as to direction and levels), traffic frequency (rates and speeds), and available materials. Only so will it have a long life and need little maintenance. There can be no one answer in all instances; what is sufficient in one case will fall short in another.

For average needs there are, broadly speaking, just two kinds of road that are sufficient for farm and estate. The major one is the 'solid', waterproofed, hard-topped road, and the minor, though often enough adequate, is the unsurfaced, wholly porous or 'colander' road. There are gradations of the hard-topped road, from concrete to slurry-bound rolled stone, but these variables are more concerned with making than maintenance.

Whichever alternative is at issue, there are two golden maxims, especially for the hard-topped road. These are freedom from *excess* moisture in the total body of the road *and its supporting land*, and complete compaction—in that order. Note that it is freedom from *excess* moisture, because too dry a road will 'dust' within itself and the 'cementation' effect and cohesion of construction materials and sub-base, will be lost—and that leads to disintegration.

Water trouble

It is useless to waterproof and seal the top of a hard road if the water it sheds just runs to the sides and there soaks into the bed of the road beneath the hard top. Similarly, a porous road must have somewhere for the surface water to get away at sides or bottom.

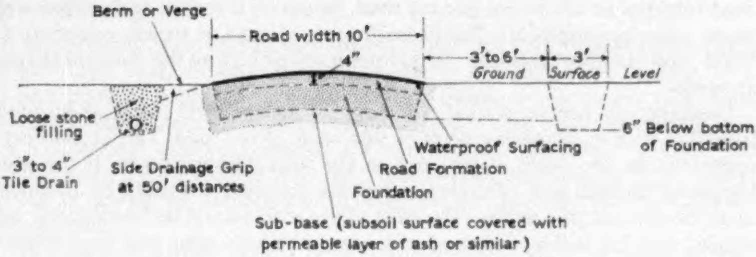
The very first act of any road repair or maintenance operation must be to examine the lie of the land as to terminal disposal of excess surface water and then form a side ditch or ditches 3 ft–6 ft away from the edge of the road to a depth at least 9 in. below the believed bottom of the real bed or sub (soil) base of the road. Thus, when traffic passes along the road, the water rising from the land beneath will have a chance to free itself through the sides. By not placing the ditch too near the road edge, a reserve tolerance is provided for self-adjustment.

The diagram at the top of p. 333 shows the related fundamental drainage factors for a road 10 ft wide.

Not a few such roads have been repaired without any additional material or surface treatment, but merely by giving adequate practical attention to the side drains and thus freeing the site of the road from excess water. On a solid road the rain goes off the top and *down* the sides; on a porous road it goes through the top and *out* the sides—to the side drains and then away.

Thus the first lesson of road repair is the same as the first lesson of roadmaking—free the body and base of the road in the shortest way from excess water. Failure in this respect is the major cause of the need of most maintenance work, or certainly the frequency for it.

A sufficient but virtually useless ditch, since the road surface is sloped away from it



What has so far been said emphasizes the importance of the subsoil. Special measures must be taken in the case of peat bog, shifting sand or clay beds. The answer to these, adopted by the Romans and not basically improved on since, will meet most needs. That is, to dig out and replace the too soft subsoil with a single or even a double layer of faggots, bavins or facines of birch, hazel, willow or even perhaps alder, possibly surfaced with giant heath and gorse, before putting on the road-making material itself. Roads over clay will often 'hole' and spume up loose, soft, semi-solid clay through the surface after severe frost. It is useless to put back road material on such places. The clay must be dug out widely and replaced by brushwood, preferably in tightly-bonded bundles 18–24 in. through and from 4 ft to 8 ft in length, with the ends alternately overlapped into each other—not end to end—and all closely laid, flat and level. Often it is easier to wait a few months after the frost has gone and the clay is a little more solid to dig out (also to receive the bundles) before attending to such places.

Compaction

Let us now consider maxim two—compaction. In the solid, hard-topped waterproofed road, this virtually means density top to bottom and side to side; even compaction by a 10-ton roller until there is no movement in the

The opposite side of the same road. Scouring has resulted because the surface water cannot get into the ditch on the other side of the road *or* escape over the edge of the road at sufficiently frequent intervals

road material at all. In the porous road, however, it means really what one might term 'containment'. But to both sorts of road, it means retention of 'form' and inability to spread—either generally or just on the outward thrust at bends.

Desirably, of course, a road will have its surface level (solid or porous) from 3 in. to 6 in. above the berm or side verge of the road. This in itself can sometimes be the cause of the edge of the road nibbling away. If this has happened through lack of design in making the road, it should be attended to as the next stage in repair. The edge of the road should be 'shouldered' by digging a trench 6–9 in. deep and wide along the road edge, and large blocks of 12 in. pitching stone laid contiguously all along the trench. In very bad instances a concrete curb may be advisable. The existing and any newly-imported road material will then be 'contained' to serve its purpose properly. Containment of the road material from spread and splatter is important and entirely necessary.

Potholes

Now that the two primary factors of moisture and compaction of the road have been dealt with, the commonly accepted starting point of road maintenance (i.e., attention to the surface) can be considered. This, of course, depends entirely on the type of road surface. Yet even so the answer is the same for all, in so far as it concerns patching surface potholes or wheel-run depressions. Point one is, when does a depression become a pothole? In practice, it is best to call it a pothole if it is anything over 1 inch below the general road surface level. Where this is the case the area must be cut out deeper and wider to a firm *vertical* edge down to a flat level bottom, and the top of this edge of the squared-out pothole must be at the same general level as the rest of the road surface—which means squaring out or circling out the pothole often enough to nearly twice its original size. This is essential; otherwise the repaired pothole is quickly girdled with a necklace of standing water that soaks into the road surface before finally drying out.

Depressions less than 1 inch deep are best dealt with by layered fillings of tar/bitumen and small chippings—larger at the bottom and finer at the top. Clean off the surface thoroughly and dress it with tar or 62½ per cent bitumen content bituminous solution (55 per cent bit. content is more often used by road repairers but, especially for patching, a stronger solution is desirable—62½ per cent is the next standard grade). Then spread a layer of clean grit-stones or chippings to give a full close covering and roll or ram and beat these tightly on to and into the surface. Repeat the process until the general road level is reached. Don't use too much bitumen, otherwise flooding and ponding will result instead of a close cohesive mix.

The filling of squared-out potholes is dealt with in exactly the same way, but starting at the bottom with rather larger stone—say 1 inch gauge, as opposed to ½ inch or even 3/16th chips or gravel used in the case of levelling up wheel depressions. A final overall surface dressing and ramming of tar or bitumen with ⅛th-inch chippings well rammed or rolled into the top of the total filling and extended well out around the sides of the depression or pothole will then complete the job to be left to set and dry out.

The wasteful practice of putting premixed tarmacadam straight into potholes without first squaring out the edge and bottom and without first putting a tack coat dressing of tar in the bottom is not recommended!

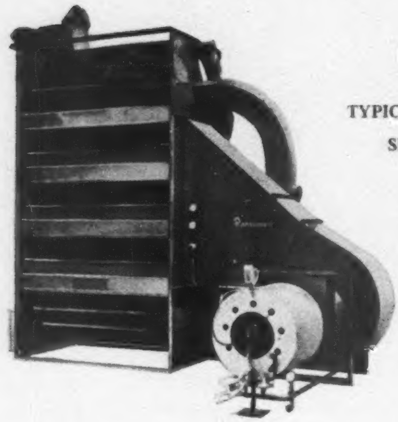
Re-surfacing

Re-surfacing of drives can vary from a virtual re-make by superimposing a 4-inch thick layer of concrete on a worn-out but hard road surface, to a 3-inch layer of premixed tarmacadam, and thence to the purely superficial spraying (tar or bitumen solution) chipping and rolling. Such concreting done by a contractor will cost probably not less than 12*s*. 6*d*. per sq. yd super, the tarmacadam carpet around 6–7*s*. and the spraying and gritting from 1*s*. 9*d*. to 2*s*. 3*d*. per sq. yd, assuming in all cases not less than, say, 200 sq. yd super being done.

In repairing a road with a total re-surfacing carpet of concrete or tarmacadam, it is vital that the thickness of carpet shall be enough—minimum 4 in. of concrete and 3 in. of tarmacadam. In frosty weather, the ground will tend to 'heave' and later re-settle, which is quite enough to fracture anything less than 4 inches of concrete. If tarmacadam is used, it is essential to apply a thoroughly sufficient tack coat of tar or bitumen to the surface of the road before the carpet is laid. It is equally essential that the depth of the carpet shall be adequate to give it its own sufficient weight and body. Failing that, the tarmacadam will part from the road surface and the rolling wheels of the traffic will cause it to 'creep', gradually to ridge, crossways to the road, and then the ridges start to disintegrate and general disruption follows. Generally speaking, a premixed tarmacadam is not by any means necessarily the best farm road surface, unless the traffic is comparatively regular, frequent and free of deposited and caked mud; free also from animal droppings. All of these are deleterious to any tar or bitumen material surfaces.

Tarring and chipping a road is a dry surface, dry weather job. If, however, bitumen solution is being used, a certain amount of dampness in the air and even on the road can be tolerated. Never use bitumen solution known to have been exposed to frost, for the solution will have been broken by the freezing of the water content and re-mixing of the solution is not possible. Size of grit or chippings used must be varied, not only to the surface being covered but relative to use of tar or bitumen. Chipping up to ¾ in. gauge can be used with hot tar dressing; whereas, with bitumen, it is unwise to use more than ½ in. chipping. The purpose of rolling the chipping is to press the stone not just on to the road, but *into* the road surface. This is too often ignored. As to the dressing, it is usual to specify the maximum number of square yards to be treated by a gallon of tar or bitumen. On a school playground, for example, a gallon will dress up to 7 sq. yd, but on a rough-textured road surface a maximum of 3 sq. yd only is desirable.

H. A. Sawyer, T.D., F.R.I.C.S., F.L.A.S., was, until five years ago, resident Land Agent to a corporate body with considerable holdings in the West Country. He then resigned from this post to take up private practice as a Chartered Land Agent on his own behalf. Many years Territorial service with the Royal Engineers gave him ample opportunity to gain experience in road making and repair, which has stood him in good stead in dealing with the problems of farm and estate roads.



TYPICAL CONTINUOUS DRIER SHOWING THERMOSTATS, THERMOMETERS AND BURNER CONTROLS

GRAIN DRIERS

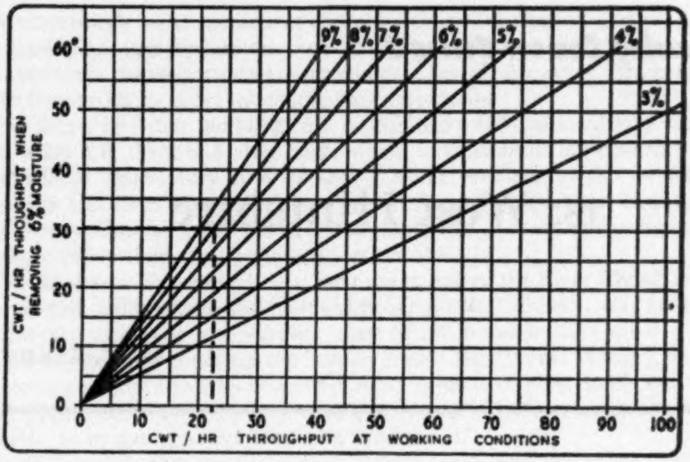
R. L. WILKINSON • J. VINTER

THE choice of grain drying systems is wide, but all are designed to do a specific job in a specific way. Any departure from this concept can lead to trouble. The choice of a drying system is of little significance compared with the need for the farmer to acquire the fullest possible knowledge to operate the chosen plant correctly.

Drying grain artificially is not an automatic process, and in spite of an impressive array of thermostats, thermometers and controls, it is the human element that is finally responsible for success or failure.

Continuous type driers are usually rated to give 5–6 per cent moisture extraction at 150°F, and this is a safe temperature for wheat intended for bread-making, etc. If more than 6 per cent moisture extraction is needed, the temptation to increase the working temperature must be resisted, but instead the throughput of the drier should be reduced and thus give the grain a longer exposure to the drying air.

As an example, a drier designed to remove 6 per cent moisture from 40 cwt of grain per hour at 150°F, will remove 8 per cent moisture at 30 cwt per hour, using the same temperature, or conversely 4 per cent moisture from 60 cwt per hour. The following graph shows other rates.



This temperature applies generally to millable wheat of a total moisture content up to 23 per cent. Above this moisture content, it is advisable to operate at a lower temperature and, if necessary, to dry in two stages, removing half the excess moisture at each pass. Great care is needed with grain for seed or malting. Temperatures not exceeding 120°F should be used, otherwise germination may be seriously impaired or even destroyed.

If bulk storage is practised a check must be kept on grain temperature, and this should not exceed more than about 10°F above ambient as it leaves the drier if 'sweating' is to be avoided. You should make sure that the drier of your choice has adequate cooling facilities.

Batch and bulk methods of drying (i.e., radial and bottom ventilated bins and floor driers) work at much lower temperatures, and although drying time is extended the risk of grain damage by overheating is avoided. High temperatures must not be used with bulk drying systems; it is a mistaken belief that an increase in working temperature will hasten drying. It can, in fact, have the opposite effect, and the right moisture extraction rate will be achieved only by using the correct temperature for the particular system.

The only method of testing grain for moisture is to use a reliable moisture meter. Its cost can be amply repaid in one season.

Thermometers, thermostats and instruments for determining air and grain temperatures are delicate; they should be treated with great care and checked periodically against instruments of known standard values. Damaged or unreliable instruments are worse than useless and can only lead to error.

The grain drier is complementary to the combine harvester, and its aim should be to help keep the combine at work without hold-up or bottleneck and produce uniformly dried samples of grain which will, according to needs, either germinate, be millable for bread- or biscuit-making, or be palatable to stock.

18. West Flintshire

G. P. Handoll

WEST FLINTSHIRE is a district of great variety and interest—as one would expect in a county rising from sea level to 1,400 ft in a distance of six miles.

To the north, the boundary is well defined by the sea coast of sand and dunes (from Rhyl to Point of Ayr) which, at low tide, extend half a mile out to sea. The wide estuary of the River Dee, with views across to the Wirral, forms the eastern limits, while the Clwydian Range of carboniferous limestone runs from north to south to make a central watershed, with the fertile Vale of Clwyd on its western side.

Being a border county, West Flintshire has much of historical interest, including a castle at Rhuddlan and traces of Wat's and Offa's dykes. But it was the lead miners who left behind the veritable battle-field of craters, spoil heaps and shafts which are to be found in many areas on the eastern slopes of the Clwydian Hills. Fortunately, this legacy affects the present-day farmer only in small areas in the immediate vicinity of the mines, for the problem of zinc and lead toxicity in plants is still unsolved. The marl pits near Caerwys are no longer worked but there are still plenty of sand, gravel, stone and limestone quarries in action.

Modern industry flourishes in the district. A very up-to-date colliery at Point of Ayr wins coal largely from under the sea and has, for some years, supplied natural methane gas to the North Wales gas grid. Lower down the estuary, at Greenfield, there is a large factory concerned with artificial fibre production, and a new glass factory has been built at St. Asaph, the smallest cathedral city in Britain, with a rapidly growing market.

It will be seen from this that any farmer wishing to employ labour must be efficient and capable of paying high wages. It is, however, probably the tourist industry, centred around Rhyl, that has the greatest impact on agriculture, for although the income per acre from caravan sites is the envy of some farmers, the flood of holiday-makers in the season provides a ready market for milk, cream, eggs, salad crops, and potatoes, giving an extra income in which many share.

In an area such as this, with varied topography and land sloping to all points of the compass, rainfall and temperature depend largely on local conditions, but the average rainfall is 35 in., dropping to as low as 22 in. around Rhyl.

A surprisingly large number of the old estates still flourish and preserve the landlord/tenant system to their mutual satisfaction, but the trend is towards more owner/occupiers, who compete fiercely for every acre coming on to the market in order to enlarge their farm units.

The farms and their buildings are traditionally built of local grey stone, with walls 4 ft thick and slate roofs which have resisted the elements for hundreds of years; they now present a solid problem to the would-be improver and farm planner! Generally, the Farm Improvement Grant has been wisely used to erect modern-style buildings of steel, aluminium and asbestos, rather than attempting to adapt the old.

The Rhyl area, in the north-west near the mouth of the River Clwyd, has a low rainfall, mild climate and light sandy soils. It is, therefore, very suitable for market gardening and supplies most of the tomatoes and salad crops needed by the local shops for the holiday trade. The farmers in this part are developing a thirst for irrigation. They have found it very profitable on their early potato crop, and are now taking advantage of the streams, wherever possible, to irrigate grassland for milk production.

Two rivers flow through the fertile Vale of Clwyd, the Clwyd itself and the River Elwy, draining the alluvial sands and silts of Triassic origin. Here are found the larger farms, with broad acres devoted to corn growing, yard-and-parlour cow keeping, and flocks of Welsh cross-bred ewes. Several areas in this region have soils derived from calcareous material, and the high lime content causes trace element deficiencies. Manganese deficiency in oats has been particularly troublesome, and this is one of the reasons why barley growing has increased.

On the east side of the Vale, the Clwydian Range rises steeply to 1,300 ft or more, with the terrain getting increasingly difficult and ending in bracken-covered slopes, used mainly as grazing for the hardy Welsh mountain ewe. Some improvement has been made on these hills by bracken crushing and similar treatments, but the greatest credit must go to the ploughman, often a contractor, who, with the help of lime and phosphate, has achieved really spectacular results.

From the tops, the land slopes eastward, undulating gently to the Dee estuary, and on this carboniferous limestone, covered with various depths of drift material, the bulk of the small mixed dairy farms are worked; typically, 40 acres, shippon for 16 cows, disused cottage piggery, and a Dutch barn for the more fortunate.

It is here that approximately 200 Small Farm Schemes have been in operation for the last 5 years, helping these tough individualists to increase their output and to improve their standard of living, mostly with considerable success. They have relied mainly on milk production from Friesian dairy cows and have used the arable grants to grow kale and Italian ryegrass. Now, as the Schemes come to an end, the big question is 'Where do we go from here?' We see the extension of groups and syndicates, the forming of larger units of production, buying and selling, and still more intensive use of land.

Some in this district have been tempted to take a factory job and turn the farm over to livestock rearing. But just as many have returned to full-time farming from the factories, with renewed determination and interest.

N. B. WOOD
Agricultural Land Service, Bristol

Bulk Grain Storage

WAVING ripe cornfields and the harvest in full swing have always provided material for the poet and painter. In these days of combines and bulk storage, the farmer himself must feel ready to wax poetical in gratitude that the threshed grain will flow, liquid-like, from field to store, unaided by manual effort. Grateful indeed until it is in store. Having this liquid-like property, it wants to continue flowing. What was once an asset now becomes a liability, one that can have dangerous, even fatal, results if not controlled.

Before examining the structural problems involved, the type of storage building and the layout must be considered. Until a few years ago nearly all grain storage on the farm followed the pattern set by merchants and compounders. This involved the use of silos some 12–18 ft in depth. Although specialized, this type of storage has the great advantage that it can be linked to complete push-button handling, and this is obviously needed by the merchant. But is it so essential to the farmer?

More recently, increased yields and continuous cropping have often led to bottlenecks at harvest time. Consequently grain has been heaped in existing buildings. The advantages of using a form of storage of more general-purpose nature than the conventional silo has become apparent. Moreover, the auger conveyor has overcome some of the handling difficulties with heaped storage, and this, in turn, has led to a revival of interest in floor drying.

However, floor storage does not lend itself to complete push-button handling and if, for instance, trouble occurs in store it may not be so easily dealt with. Mention has been made of the general-purpose nature of buildings for floor storage, but if corn is to be held for long periods, the opportunity for alternative use is limited. It is of more importance where there is a likelihood of considerable fluctuation in the corn acreage.

The third alternative is the storage of undried moist corn in sealed tower silos. Corn stored in this way is only suitable for stock feeding on the farm. It is therefore a form of fodder, rather than grain, storage, and where barley is grown for feeding direct to stock, it may well be worth considering.

When deciding upon the type of storage most suitable on a particular farm or group of farms it is necessary to consider (1) the quantity to be stored

(2) whether this is likely to fluctuate (3) the period of storage (4) the frequency of handling required.

Where the quantity of corn is likely to be consistently large over the years and/or facilities for frequent handling are required, then some form of silo storage is to be commended, linked to either a continuous or in-bin drier.

Where the quantity is likely to fluctuate and/or the corn is to be sold off at the first opportunity, then floor storage in a general-purpose building is usually a better proposition, with either a continuous drier or ducted-floor ventilation. The answer usually falls between the two. Silo storage for the permanent corn acreage with floor storage for the overflow.

What of the constructional problems involved? In the early days of bulk storage on the farm most prefabricated silos were circular. These were wasteful of floor space inside buildings and therefore construction in brick or concrete block was generally preferred. Where a high standard of workmanship is available, and the silos are designed competently with proper reinforcement incorporated, such construction is often still useful, especially where silos of a non-standard size are needed. Nowadays a wide range of prefabricated circular and rectangular silos is available and they have much to commend them, particularly where there are no facilities for locally-constructed silos. Independent roofs can be fitted, providing self-contained package units.

Up to half the weight of grain in a silo can be carried by friction on the walls, and where the silo is of post and panel construction this loading is transmitted to the corner posts. The foundations at the corners of such silos need to be increased accordingly. All floors for grain stores should have a waterproof membrane, which must be below the reinforcement usually needed.

Silos should be carried over the central conveying tunnel to reduce costs, taking care that the dividing wall is to one side and not on the roof of the tunnel. Outlets must always be in the floor and never in the wall. The tunnel needs to be carried beyond the silos with an escape hatch. Where floor storage is combined with silos, additional inlets can be provided to the bottom conveyor to which grain can be augered or tractor-shovelled. Floor storage can avoid the need for pits, and in any case pits should be shallow with high speed elevators to above-ground silos. There is much to be said for metal liners, especially where water is a problem.

Although grain is similar in many ways to liquids, it has one advantageous difference. It has an angle of repose, i.e., it will form heaps. There is, therefore, always a downward pressure upon the floor. When adapting existing buildings this advantage should always be used. The downward pressure of the heap will counterbalance the outward pressure on the walls, provided there is a rigid joint at their junction. These counterforted walls can now be bought in a prefabricated form. Never load existing walls or stanchions without advice.

New framed buildings can have the stanchions designed to carry the wall loading. This loading, with a storage height of 8 ft, can be over half a ton per foot run of wall, placing a loading on stanchions at 15-ft centres of approximately ten tons. So take care.

Fitness for purpose has always been a cardinal principle of building design and nowhere is this truer than of grain storage buildings, both in layout and construction.

IN BRIEF

Ironstone and Agriculture

Many readers found a special interest in the series of articles which Mr. Morley Davies contributed on the subject of restoring agricultural land after opencast mining. They will similarly be interested to know of a new brochure, printed in full colour, entitled *Ironstone and Agriculture*, issued by the National Council of Associated Iron Ore Producers. Since 1945 the British steel industry has taken between 15 and 20 million tons a year of home iron ore. Most of it has come from the five Midland counties of Lincolnshire, Leicestershire, Rutland, Northamptonshire and Oxfordshire.

It is the purpose of this 30-page brochure to explain the economic importance of our home ore resources, and also to demonstrate the various measures taken to restore land after working to agricultural use. Since the Mineral Workings Act of 1951, all but a small fraction of the land worked for ironstone has been returned to agriculture, with the aid of direct contributions of £110 per acre from the ironstone operators, supplemented by grants from the Ironstone Restoration Fund.

Copies of the brochure can be obtained free from P. T. M. Wilson, Secretary, National Council of Associated Iron Ore Producers, P.O. Box 8, 48, Meadow Road, Kettering, Northants.

Drying Grain on the Floor

In those areas where grain can be harvested with a fairly low level of moisture content (up to 21 per cent), grain drying on the floor is an attractive idea. Principle and practice are similar to storing grain in ventilated bins. The only differences are the method of distributing the drying air, layout of the main air duct, dividing up the store where necessary into separate drying areas, and filling and emptying the store.

The way it works is that the grain is loaded on to the floor of the building to a level height of 6–8 ft, starting from one end of the building and loading back to the other end. Slightly warmed air is delivered through a main air duct and thence through a series of smaller lateral ducts, fitted with individual air inlet doors, through the mass of grain. Ventilation can begin when the first two or three lateral ducts are covered with grain.

A square or rectangular building of almost any size is suitable for floor drying, but a very wide building (over 40 ft) will require a centrally disposed main air

duct to restrict the lateral duct length. A height of 12–14 ft to the eaves is adequate, but to facilitate movement of elevating and conveying equipment during loading and unloading, roof trusses which offer a minimum of obstruction are a great advantage. The floor must be thoroughly waterproofed, level and, if possible, smooth textured.

Expert advice should be taken before deciding on the use of existing walls, or the construction of new ones. Suitably reinforced brickwork and reinforced concrete block can be satisfactory, but sheet or corrugated galvanized steel, supported by one or more intermediate posts between stanchions, is likely to be cheaper and preferable. Timber may also be used. For that part above the intended loading or storage height, cladding to the eaves with light protective material is adequate.

To release the large volumes of moisture-laden air, up to 2 sq. ft outlet area per 1,000 cu. ft of air per minute at the maximum ventilation rate, should be provided.

A leaflet (STL 22) on this subject is available free from the Ministry's office, Tolcarne Drive, Pinner, Middlesex.

Soil Magnesium

Much has been written and spoken about the occurrence of hypomagnesaemia and grass tetany in recent years and its likely relationship with low magnesium in pasture herbage. This relationship between the magnesium content of herbage and hypomagnesaemia is not, however, simple or direct, since total magnesium is only one of the factors which influences the magnesium content of the blood of the animal. Nevertheless there is evidence to indicate that measures taken to increase the magnesium content of the herbage reduces the likelihood of hypomagnesaemia occurring.

Work on this subject at Trawscoed Experimental Husbandry Farm, Aberystwyth, over five growing seasons, has given the following results:

1. The magnesium content of herbage is generally at its lowest in spring or early summer and at its highest in late summer or autumn.
2. Application of 5 cwt/acre Epsom salts raised the magnesium content of a mixed sward by 18 per cent in the year of application, but in subsequent years its effect was small. Higher rates of application would probably prove uneconomical, as compared with Dolomitic limestone.
3. Dolomitic limestone, although not having its full effect until about three years after application, raised the magnesium content of herbage by over 40 per cent, and where land requires liming this material is undoubtedly the cheapest source of magnesium to apply. Its effect is also long lasting.
4. White clover, which is present in most grazing swards, had a very similar magnesium content to that of Italian ryegrass and cocksfoot, whilst red clover contained about 50 per cent more magnesium than white clover and the grasses.

Operations on Animals

After 10th August, when the new Protection of Animals (Anaesthetics) Act 1964 comes into operation, it will be obligatory to use an anaesthetic when castrating dogs, cats, horses, asses and mules of any age, goats and pigs over two months of age and calves and lambs over three months.

From this date the use of rubber rings or similar devices will also be forbidden for castrating bulls, pigs, goats and sheep or for docking lambs' tails, unless applied during the first week of life.

The Act also lays down that an anaesthetic must be used when de-horning cattle; and for dis-budding calves, unless this is done by chemical cautery during the first week of life.

Cheaper Electricity in the Poultry House

Any saving that can be made in the production of table poultry and eggs is welcome. One that offers is to take advantage of off-peak storage heating, and to this end the Electrical Development Association has made an excellent colour film '*Electric Heating for Poultry*', well compèred by Dr. David Sainsbury.

The film shows the application and advantages of storage heating systems applied to chick brooding, growing stock and hatcheries, and these are underlined by first-hand reports of poultry farmers using heat storage systems in various parts of the country.

This film is the third of a recent series dealing with poultry environment. The first two were made by the Ministry of Agriculture and dealt with lighting and ventilation.

All poultry farmers should see this film. Copies on 16 mm. are available on free loan from EDA Library, 2 Savoy Hill, W.C.2. It runs for 20 minutes.

Two stills from the EDA film 'Electric Heating for Poultry'

Left: A heated 'path' brooder being made ready to receive chicks
Right: Chicks on a heated floor storage brooder

The approximate cost of materials for a floorstore brooder 6 ft × 6 ft × 1 ft is given as £11 9*s*. (excl. concrete). Plus installation costs, say £25 per brooder.

Books

Fish and Chips. A. G. STREET. Robert Hale. 15*s*.

Without benefit of cover or title page, no one familiar with country literature would have any difficulty in recognizing this book as the work of A. G. Street. Here are the earthy humour, the forthright and often startling opinions, the unsurpassed intimacy with the rural scene, the sympathy with country characters of all classes and the love of country sports which we associate with our doyen of farming writers.

At first reading I thought I detected a flaw. Everyone in the novel is so sensible, so logical; there is no unreasonable villain. Then I realized that the villain is the hero himself, Gordon Roper, a man who engenders stress and conflict in the minds of his neighbours as he serenely steers his carefully chosen course. He disregards custom and convention—everything except that calculated to add to his own well-being.

His rearing by an ultra-respectable and an impecunious maiden aunt not only forces him into the habit of hard, sustained and intelligently directed work but develops in him the conviction that the one thing that matters in life is—money. When thus thoroughly indoctrinated, he is left a fortune by the proverbial rich Australian uncle.

The rest of the book is about how he spends, or rather invests, the money. Having bought a thousand-acre chalkland farm, he settles down to a way of life which scandalizes his neighbours. He farms without livestock; he sells his lovely, stone-flagged house and 300 acres of valley land, erecting a modern, utilitarian residence on the edge of the Downs. Yet the new house, designed by himself, is a model of comfort and efficiency. Too selfish to marry, he installs a trained manservant so efficient that his neighbours' wives go away from his dinner parties fuming with exasperation.

Does Nemesis catch up with him? It would be unfair to reveal the end of this entertaining story.

R.W.

Agriculture in Wales during the Napoleonic Wars, 1793-1815. D. THOMAS. Univ. of Wales Press. 30*s*.

This geographical interpretation of historical sources has entailed a great deal of research, as well as considerable care in the interpretation of the information available. Mr. Thomas has not only exercised a critical approach, but has presented what could well have been a dull mass of figures and information in the form of a logical and interesting account. The book will be of interest to sociologists and geographers as well as historians and agriculturists, in that it covers a wide range of aspects of the Welsh countryside during the period under review.

The turn of the eighteenth century was a time of great change for Welsh agriculture, which, for a variety of reasons—including lack of roads and poor forms of communication generally—had lagged behind in agricultural developments compared with much of lowland England. Scarcity of food, and better prices because of the Napoleonic Wars, brought about tremendous changes in the rural picture in Wales. Land enclosure received a great impetus and resulted in much hardship, especially for the small farmer.

In fact, it is interesting to note how many of the problems of those days were similar, in principle, if not in detail, to present-day difficulties, e.g., rural depopulation, the drift of workers from the land because of better wages in industry, the need to adopt new methods, and the high values of land. Continuous cereal growing was even then a source of concern—five successive crops of oats were apparently quite common in parts of mid-Wales.

Apart from the many descriptions of agriculture and rural life in Wales, the main outcome of this book can best be summarized in the author's own words:

> 'One of the most striking features to emerge from this study is the influence which physical conditions exerted upon the utilization of land; a factor which operated as strongly in areas of agricultural change as in areas of agricultural stability. This was evident in the study of crop distribution . . . ' ' . . . the barrier created by the mountain spine of the country was of great geographical importance.'

This is a scholarly work which will be of great value to those with an historical interest in factors affecting changes in farming systems and patterns of land use.

W.E.

The Young Man's Guide to Farming. P. S. HOUGH. Hamish Hamilton. 18*s*.

Several books have been produced over the years offering an introduction to farming. In most cases the advice is aimed at young men who intend to take up farming with—as a sort of consolation—words of wisdom to those who will not catch the farming bus, but will have to be satisfied with jobs in commerce or in the advisory and educational services.

Mr. Hough is a Cotswold farmer of wide experience. His book is aimed quite clearly at young men who expect to *farm*, but he spares a thought or two for the others. The advice is realistic, and he pulls no punches on the need for adequate finance. The suggestions as to training and education are sound, although there might well be a stronger suggestion that young men of this type should seek proper educational advice—there is someone qualified in every county to deal with all queries and to put these farmers-to-be on the right training path.

The standard of this book presupposes a good degree of understanding from the reader. Although well and clearly written, it is directed to the *bright* young man—the boy from grammar school or public school who wants to get established in farming. It gives a very clear picture of good technical business-styled farming today. The chapter on '£ *s. d.*' could be read with advantage by many farmers, and is probably beyond the range of the young man. Its concentration on the efficiency factor system of farm management analysis is correct within the bounds of this book, but may meet with argument from advocates of another system.

No one who writes a book of this type seems able to do without an historical section, although it is a pretty well-worn road to follow. This book is no exception. It gives a good pocket history of British farming, but I doubt if the book really needs a section of this length. The first two parts—'British Farming Today' and 'How to Become a Farmer'—provide the real meat of this worthy book.

G.S.B.

The Stud Farm. VINCENT ORCHARD. Stanley Paul. 42*s*.

Among the millions of people who follow horse-racing all over the world, there can be only a very small number who have any idea how the horse in training is produced or how the thoroughbred was evolved. Mr. Orchard has sketched the outlines of the bloodstock industry in an easily readable form, and it will surely have a wide appeal.

As stated in the preface, this is not a text-book; it will be read for enjoyment. Nevertheless, it offers a wealth of knowledge and information, made easily digestible by the fluent and informal style. The chapters are planned to take the reader through the phases of breeding, from the mating of the mare, on through the stages of foal and yearling, up to the time of joining a training stable or being sent to the sales.

The underlying theme is one of progress—progress through collaboration between breeders, the veterinary profession and agriculturists. The importance of farming routine must be recognized in relation to problems of ill-health associated with live-stock management. The necessity for pasture management, parasitic control and the place of cattle in the economy of the stud are all mentioned, but only briefly; a chapter devoted entirely to this aspect of a stud farm would have been welcome.

An introduction to the fascinating subject of pedigrees and families could well whet the appetite for further reading. Perhaps it will create a new interest for the punter, who has previously been exclusively absorbed in the study of form, but may now look at the breeding of the horses he fancies. There is no rule-of-thumb in genetics; there are too many exceptions to the rule, and the greatest and most experienced of breeders are the least dogmatic. One can aim by selective matings at reproducing the desirable qualities of sires and dams, and more particularly at eliminating undesirable influences in a pedigree, but there still remains a considerable element of trial and error.

There is a delightful vignette of Hyperion in retirement. I saw the old horse about six months before he died, and Mr. Orchard's brief word picture is near perfect.

D.A.G.

A Design for Farming. C. S. BARNARD and W. C. WESTON. School of Agriculture, Cambridge. 4*s*. 6*d*.

This report considers a reasonably homogeneous group of farms in North-west Essex. They are essentially grain with root holdings, situated on heavy boulder clays. With this as the basis, Barnard and Weston examine the feasibility of applying sophisticated farm planning, made possible by the advent of the computer, to a number of farms.

Such an approach is attractive to farmers in that it considers not only a vast number of alternative plans but looks to the future when labour may be even scarcer than it is today. The several systems of farming described spell out the detail of how the 'model farm' might be run with four, five or six men in order to make optimum use of the farm's resources.

How will plans developed in this way suit the individual holding? The answer must depend on how closely the computed farm resembles the actual farm in respect of the quantity and quality of resources, as well as the yields and methods of production of the various enterprises.

Most of us now recognize that each farm is unique and planning must therefore be on an individual basis; but computers are capable of handling very complicated situations, and thus will help advisers or farmers to avoid unrealistically over-simplified solutions. Indeed, despite the limitation of being able only to calculate from the data it receives, the computer will help to find the paths which lead to the most profitable combinations of enterprises.

Although it is unlikely that computers will ever be used on a large scale to plan individual farms, *A Design for Farming* should be studied by those interested in farm management; it will help them recognize the scope for planning but also demonstrate the limitations of the 'computer approach'.

M.W.T.

Human Ecology. Sir George Stapledon. (Edited by Robert Waller). Faber and Faber. 30*s*.

Those who have read Stapledon's earlier books may well wonder what this one is about. It portrays the culmination of 'Staps' thinking, in which he attempts to visualize the *integration* of man within both society in general and his environment in particular. The chief environment which Stapledon had in mind was, of course, farming and the countryside. One can see the evolution of his thinking, beginning in his earlier days with plant-soil relationships, leading through the animal to farming in general; then from farming to country folk, thence on to society in Britain and finally in the world at large.

The book is overflowing with ideas. Many are old, some are new, but all are advanced with the vigour and enthusiasm of Stapledon that many of us knew and sadly miss today. As in the case of many enthusiasts and pioneers, there is much in this book with which the readers will not agree, and the application of many of the ideas is left in mid-air while much of the philosophy is clothed in sentiment and a yearning for days and conditions gone by.

It is unlikely that this book will appeal to a wide public, but it is one which could well be read with profit in the hope that at least some of the ideas and suggestions might be adopted to evolve a better Britain (and possibly a better world) for future generations to live in.

'Staps' friends will be grateful to Bob Waller for editing this part of a manuscript left unfinished by Sir George when he died in 1960, as an indication of the great and kindly man that he was and whose concern above all else was for people and real human happiness.

W.E.

Weather and Man. H.M. Stationery Office. 3*s*. 6*d*.

A thought-provoking essay on our dependence on weather has just been published by the World Meteorological Organization under the title 'Weather and Man'.

The principal author of this booklet is the British scientist, L. P. Smith, who for many years has been in charge of the Agricultural Branch of the Meteorological Office. Although dealing with the obvious (and in some cases not so obvious) effects of weather on farming activities, Mr. Smith covers also such diverse subjects as Industry and Trade, Insurance, Health, Tourism, Sport, and Legal Matters, all in their relation to weather and climate.

The main object of the booklet is to bring to the attention of industrialists, builders, engineers, farmers, doctors, etc., the economic and social advantages likely to accrue from their taking into account when planning not only known climatological facts but, where relevant, also the forecast weather conditions likely to affect their operations. It shows how worthwhile can be the advice of professional meteorologists—widely used for some years in the U.S.A.—whose services have always been more highly valued by specialist customers than by the general public.

Weather and Man is written for the layman in an attractive non-technical style and is well illustrated. It is obtainable from the Government Bookshops or through any bookseller.

BOOKS RECEIVED

Report and Proceedings of the Eighteenth Oxford Farming Conference, 1964. 7*s.*

Obtainable from M. H. R. Soper, Dept. of Agriculture, University of Oxford.

•

University of Nottingham School of Agriculture Report for 1963. 6s.

Guild of Agricultural Journalists Year Book, 1964. 30*s.*

Obtainable from the Graham Cherry Organisation, 41 Parliament Street, London, S.W.1.

•

Complete Catalogue of Farming and Gardening Books. Faber and Faber.

Agricultural Chemicals Approval Scheme

Since the publication of the 1964 List, the following products have been approved:

HERBICIDES

CALOMEL
Lawn Sand Formulation for Dry Application
Fisons Mosstoll—Fisons Horticulture Ltd. Harvest House, Felixstowe, Suffolk. (Felixstowe 4444).

DINOSEB
Formulation in Oil
Comma-Cide DNBP. Potato haulm killer—Comma Oil Co. Ltd.

ACKNOWLEDGMENT OF PHOTOGRAPHS

We gratefully acknowledge permission to use the following photographs:

P. 299 The Mustograph Agency. P. 305 J. C. Matthews. Pp. 306 and 307 C. L. Johnson. P. 318 *Farmer's Weekly*. P. 322 Animal Breeding Research Organisation. P. 329 National Institute of Agricultural Engineering. Pp. 332 and 333 H. A. Sawyer. P. 336 Ransomes, Sims and Jefferies Ltd. P. 344 Electrical Development Association.

AGRICULTURE

Price 1s. net monthly (by post 1s. 5d.).

Subscription Rates (including postage):

Home and Commonwealth: 14s. per annum. Foreign Countries 15s. per annum

Subscriptions may start with any issue and should be sent to:

HER MAJESTY'S STATIONERY OFFICE

York House, Kingsway, London W.C.2
13a Castle Street, Edinburgh 2
39 King Street, Manchester 2
35 Smallbrook, Ringway, Birmingham 5
423 Oxford Street, London W.1
109 St. Mary Street, Cardiff
50 Fairfax Street, Bristol 1
80 Chichester Street, Belfast

Single copies can be purchased from any of the above-mentioned addresses or through a bookseller, price 1s.

Printed in England for Her Majesty's Stationery Office by Hull Printers Limited, Willerby, Hull, Yorks.

(K126) 72-1-64-7

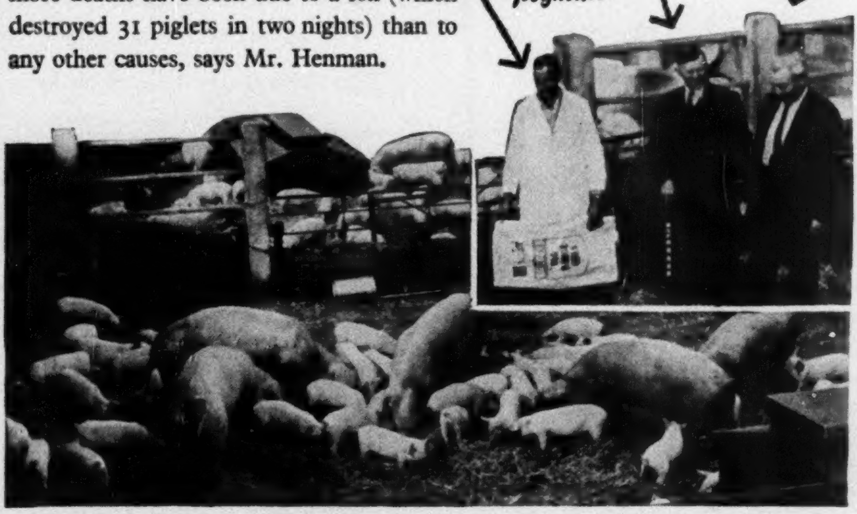
PEOPLE IN PIGS in Oxfordshire

In less than three years Mr. Henman has built up a 75-sow Landrace herd for the production of growing and in-pig gilts so successfully that the demand usually outstrips supply.

The sows are fed Pig Range Cobs both when on range and while nursing. This saves labour, produces big litters and strong rearable piglets, and affords such a complete and balanced diet that bullying is unknown—"it's an affable herd", says the Silcock Agent.

Pig Creep Pellets are used at around 16 days of age and the litters average over nine reared at 41 lb. weaning weight.

Winter and summer, losses from birth to weaning are under two per litter: this year more deaths have been due to a fox (which destroyed 31 piglets in two nights) than to any other causes, says Mr. Henman.



SILCOCKS *R. Silcock & Sons Ltd. Stanley Hall, Liverpool 3*